Electrical World

The consolidation of ELECTRICAL WORLD AND ENGINEER and AMERICAN ELECTRICIAN.

VOL. LIII. NEW YORK, THURSDAY, JUNE 10, 1909. No. 24.

PUBLISHED WEEKLY BY THE

McGraw Publishing Company

JAMES H. McGRAW, President.
J. M. WAKEMAN, 1st Vice-President. A. E. CLIFFORD, 2d Vice-President.
CURTIS E. WHITTLESEY, Secretary and Treasurer.

239 WEST THIRTY-NINTH STREET, NEW YORK.

TELEPHONE CALL: 4700 BRYANT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

EDITED BY T. C. MARTIN AND W. D. WEAVER.

CHICAGO OFFICE.....590 Old Colony Building
CLEVELAND OFFICE.....1015 Schofield Building
PHILADELPHIA OFFICE.....Real Estate Trust Building
EUROPEAN OFFICE....Hastings House, Norfolk St., Strand, London, Eng.

TERMS OF SUBSCRIPTION:

United States, Cuba and Mexico.....per year, $3.00
Dominion of Canada..... " " 4.50
Other Foreign Countries within the Postal Union..... " " 6.00
25 shillings. 25 marks. 31 francs.

Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies of issues prior to July, 1907, are kept on sale, except in bound volumes. Subscription orders being renewable at the end of the month indicated on the wrapper, the sending of remittances on or before that date will be much appreciated by the publishers.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Thursday of the same week.

Copyright, 1909, by McGRAW PUBLISHING COMPANY.

Entered as second-class matter at the post office at New York, N. Y.

The circulation of Electrical World for 1908 was 898,000. Of this issue 16,750 copies are printed.

NEW YORK, THURSDAY, JUNE 10, 1909.

CONTENTS.

Editorial 1427
Meeting of Association of Car Lighting Engineers..... 1432
Meeting of Railway Signal Association..... 1432
Ohio Electric Light Convention..... 1432
Prize Competition for Design of Ornamental Poles..... 1432
Reversal of Revocation of Foreign Patent in Great Britain..... 1432
President Maclaurin Inaugurated at Boston "Tech"..... 1432
Vanderlip on Electrical Securities..... 1433
Protection Against Theft of Electricity..... 1433
New Officers of the A. I. E. E..... 1434
A. I. E. E. Frontenac Convention..... 1434
Producer Gas from Texas Lignite..... 1434
Exclusive Telephone Service and Common Carriers..... 1434
Electrification of Railroad Terminals..... 1435
Decision in Leominster Electric Rate Case..... 1435
Chicago Street Railway Rehabilitation..... 1436
Meeting of the Boston Section A. I. E. E..... 1437
Domestic Production of Mica..... 1437
Massachusetts Legislative Notes..... 1437
New York Public Service Commission News..... 1437
Process of Making Hard Fibre..... 1437
Report of Proceedings of Convention of National Electric Light Association 1438
Convention Notes..... 1445
Accounting System of the New York Public Service Commissions... 1446
The Patent System in Its Relation to Industrial Development..... 1448
Discussion of Technical Papers..... 1449
Current News and Notes..... 1450
Central-Station Practice and Results from Waterloo, Ia..... 1451
An Exact Method for the Determination of the Efficiency, Regulation or Size of Transmission Conductors. By Harold Pender... 1454
Power Plant of University of Washington..... 1459
Report of N. E. L. A. Committee on Grounding the Secondary..... 1461
Protection from Lightning..... 1462
Abstracts of Convention Papers and Discussions..... 1463
New Telephone Patents..... 1491
LETTERS TO THE EDITORS:
Calibrating the Ballistic Galvanometer. By B. B. Brackett..... 1492
The Tariff on Mica. By Frank N. Meyer..... 1493
Patent Abuses. By Frank Z. Maguire..... 1493
Digest of Current Electrical Literature..... 1494
New Apparatus and Appliances..... 1499
Convention Exhibit Echoes..... 1503

GROUNDING OF THE SECONDARY.

It is most gratifying to note the free and full discussion which took place at Atlantic City on the report of the N. E. L. A. committee on the grounding of the secondary, and also that the part of the resolution of the committee presented last year and adopted, which would prohibit the grounding above 150 volts, was reconsidered and upon vote rejected. The opinion expressed in the discussion was practically unanimous that such a prohibition was entirely inadvisable, whether judged by policy, life risk or fire hazard. As pointed out by Dr. Steinmetz, the attitude of the committee on the question, if finally adopted by the association, would place that body in direct conflict on a technical question with the American Institute of Electrical Engineers, which favors grounding up to 250 volts, thereby injuring the prestige of both bodies with the public; and, moreover, since the standard voltage for secondary distribution in Great Britain is 220 to 250 volts, the association should realize the effect abroad, as well as at home, in the case of double voltage systems, of its official condemnation of such voltages as fatal to human life. As regards fire hazard, Dr. Steinmetz expressed the opinion that to reduce this to the minimum every circuit which enters a building, whether of 110 or 1000 volts, should be grounded.

The extraordinary position of the committee that alternating-current voltages in the neighborhood of 200 volts are fatal to human life received no support. To quote Dr. Steinmetz: "Fifty volts may kill if the contact is sufficiently good, but 250 volts, in my opinion, would hardly ever kill; it must be a very unusual condition and very perfect ground for a shock of 250 volts to kill." The final conclusion of Dr. Steinmetz was that safety with respect to both fire hazard and life risk lies in permanent grounding of secondary circuits regardless of the voltage, combined with a safe insulation of such circuits. A point brought out several times in the discussion was that, granting a danger normally from grounded secondaries, this can be provided for by insulation precautions, while no means are feasible other than grounding to protect against fatalities from abnormal voltages due to defective transformers, crosses, etc. This part of the discussion should have a good effect in directing attention to the proper insulation of alternating-current interior circuits of higher voltage in order to guard against the discomfort and possible danger of shocks from such circuits when grounded. Safe house wiring, even with low voltages, requires that one should not have a chance of being subjected to the circuit voltage. A proper precaution is that all lamps operated at high voltages should be installed in sockets having no exposed metal, and, so far as possible, controlled by wall switches, also without any exposed metal parts. The matter of the insulation of secondary circuits should, in fact, be made the subject of careful study by a committee of the association or of the American Institute of Electrical Engineers, or better, by a

joint committee of the two bodies, with a view to laying down rules that should be rendered obligatory as soon after adoption as practicable.

An important matter in connection with grounding relates to the attitude of municipalities and water companies toward the use of water pipes for grounds. Unquestionably water pipes make the easiest and safest ground for secondaries, and there is no adequate reason whatever for forbidding their use. There is no record of the slightest trouble of any kind arising from such grounds, and it is difficult to see how any could occur. A ground that is unreliable is a source of danger, and when first-class grounds can be had upon water pipes, ordinary considerations of safety indicate their use. In cases where water pipes are unavailable, the committee makes in its report pertinent suggestions for good substitutes. Some, however, will not fully share the optimism of the committee in its statement that electric-lighting companies do not hesitate to ground on account of the cost, but on account of being unable to secure grounds that are always reliable. On the contrary, there will linger a suspicion that the cost of making such grounds as the committee recommends is the chief and almost the only obstacle to grounding. If such grounds could be installed for 50 cents apiece, ungrounded secondaries would be as rare as grounded ones are now. Somewhere between 50 cents and $15 or $20 lies the figure at which the consumer is allowed to take the chance. A company mulcted in heavy damages once or twice can generally be trusted to find a method of grounding sufficiently near "always reliable" for installation with startling promptness. We do not think central-station men are more heedless in such matters than are other business men. On the contrary, their knowledge of and frequent contact with the real dangers of the situation makes them on the whole more mindful of danger to the public. Yet they are too apt to let the grounding matter slide along from year to year on one inward pretext or another for the sake of the balance sheet. It is only human, but it is taking chances that no conscientious man should wish to assume. The central-station man is his brother's keeper whether he will or no.

Performance Specifications and Ratings.

Among the papers read last week at the N. E. L. A. is one by Mr. W. L. Waters on "Performance Specifications and Ratings" of generator units, a very interesting and important subject. The paper criticizes the existing standard specifications for alternator units in two particulars—first, in regard to rating by temperature, and, second, in regard to rating for power-factor. The paper points out that the operating engineer does not care about the exact temperature elevation under load of the different parts of the generator he has purchased. What he wants to know is how much load the generator can be guaranteed by the maker to carry, and then the temperature of the machine is the maker's affair. If the machine, after being subjected to this guaranteed load, becomes injured thereby, it is contended that the purchaser should, under the purchasing contract, secure redress from the maker.

This method of guaranteeing performance in a purchaser's contract might work excellently between particular makers and purchasers, but it would pave the way to endless disputes and litigation between other particular parties, since it would substitute an indefinitely measurable promise for a definitely measurable promise, and under stress of competition between makers, would prompt the offering of unjustifiable promises, based more on hopes than on observable facts. It is true that under the existing standardization rules of the American Institute of Electrical Engineers all ratings must conform to certain specified temperature-elevations, and that certain types of machine structure would be at their safe limits under those elevations, while other types of machine structure could safely carry higher temperatures. There is certainly, to this extent, good ground for the criticism given in the paper. The best way of dealing with the matter, however, is not to throw away the rules for temperature rating, but so to modify them, in the light of recent experience, that different types of insulation can be allowed different temperature-elevations. If the existing temperature ratings were abolished, it would be possible for a purchaser to contract for a generator that the manufacturer guaranteed to carry its assigned load indefinitely. If the station where the generator was installed were new, and the load of the machine were not immediately obtainable, it might be several years before the purchaser was actually able to find the rated load for the machine, and then only for, say, two hours daily. If the machine were unable to carry this load continuously, as guaranteed, it might well happen that the injury due to excessive temperature in the machine would not develop to a serious stage for, say, another two years. Under such conditions the purchaser could not secure redress under his contract in less than five years after his purchase. No maker would consent to a retention of any considerable amount of the purchase price until such time as the purchaser could comfortably find the full load for the machine and secure sufficient experience with it to feel satisfied about the durability of his bargain. On the other hand, there may be defects in the present standardization rules, but at least the purchaser is able to participate in tests before the machine leaves the factory. These tests are admittedly competent to demonstrate within a small range of error the temperature-elevations of the sensitive parts of the machine under continuous rated load; so that, if these elevations are conservative, the purchaser may be perfectly satisfied as to the normal behavior of his generator. Any dispute on the matter is thus brought to a climax before the machine is shipped.

The second criticism, in regard to power-factor, is well taken. Too little attention is paid to this matter. A single-phase alternator of, say, 5000 kw, at 5000 volts, is defined by standardization rules as capable of delivering continuously 1000 amp, non-inductive, under rated terminal voltage of 5000 volts, without excessive heating at any part. If, however, the load has a power-factor of 80 per cent, it is commonly supposed that the machine could still deliver 1000 amp at 5000 volts with 4000 kw real power-delivery and 5000 kilovolt-amperes. But the machine may not be able to do this. It could supply 1000 amp, but under the increased internal drop with lagging current it might not be able to maintain 5000 volts at terminals. At all events, there would probably be some power-factor at which the rated current would not be delivered at rated volts, unless the machine were specially designed for such work. It would thus be well to specify, with each generator, not only its rated non-inductive load-current, but also its maximum current under rated voltage at some particular power-factor or power-factors. In the example above assumed,

the rated non-inductive load current being 1000 amp, it might be, say, 950 amp at 80 per cent and 800 amp at 70 per cent power-factor. In fact, alternator specifications frequently contain such provisions at the present time. It is clearly the duty of the operating engineer to arrive at an estimate of the power-factor of the load that will be imposed upon his generator plant when installed. His specifications should call for a generator capable of supplying the actual load at that power-factor. As is pointed out in the paper, the mistake is too often made of neglecting the power-factor, and of ordering an alternator merely of an assigned power in kilowatts. The maker cannot be blamed for filling these specifications in the easiest way—that is, with a generator designed for substantially non-inductive load. Some generators actually work under conditions as favorable.

PROTECTION FROM LIGHTNING.

The report of the committee on this important subject may best be summarized by the following misquotation from the text of it: "The practice of installing ————, which has been followed by most companies operating transmission lines, is to be commended, although conclusive proof of their usefulness is lacking." In the original the space left blank above is occupied by the expression "choke-coils," for which almost any other item of protective apparatus may properly be substituted. In spite of this lack of precise conclusions, the committee has presented a report well worth consideration. Lightning is not a thing which can readily be submitted to experimental conditions, and hence protecting appliances as commercially installed cannot be expected to yield at once definite data as to their value. On the whole, the facts accumulated seem to indicate that trouble on distributing systems has been materially decreased within the past few years. How far this is due to improvements in protection, and how far to higher standards of insulation, is not so easy to determine. The growing practice of grounding the secondaries seems to have been productive of good results. The committee advises the use of pipe grounds for lightning arresters as adequate and convenient, and points out that so far as multiplicity of arresters goes, it can be grievously overdone. Two thousand feet is suggested as a good normal spacing for the arresters on distributing systems.

This matter of spacing is one of mere economics. A burned-out arrester may shut down service just as effectively as a burned-out transformer; besides the cost of replacement, and as a certain proportion of arresters are due to burn out in service, one may easily install too many. The experience of one large plant was that the cost of arresters in fixed charges and upkeep, and interruptions due to their burning out, exceeded the similar quantities for the transformers they were supposed to protect. It consequently has decided to use fewer arresters in the future. Yet no one is disposed to doubt that a moderate number of well-installed arresters forms a paying investment. One might go further and say that a few thorough installations do better in the long run than a similar investment put into cheaper apparatus installed less carefully. The committee calls particular attention to the importance of thorough inspection of line arresters. On transmission lines experience indicates that the chief troubles are on the lines themselves, and that the arresters as installed in stations are pretty effective in saving the other apparatus from damage. As to the lines, it would have been interesting had the committee carefully summarized the failures of the past year due to lightning. In particular it would be useful to know whether the grounded wire recommended has actually served to prevent breakdown in all or a vast majority of cases. How many lines having grounded wires as protection broke down from lightning, and what was the relation of the ground wire to such immunity as was observed? If the ground wire really does the work regularly and reliably, the minds of many transmission line operators will rest more easily.

Previous experience has shown the ground wire, like the choke coils mentioned by the committee, to be of probable but indeterminate usefulness, and the somewhat definite attitude of the committee regarding the former would seem to call for fuller explanation, as indicating a really important advance in the art. The suggestion of actual lightning rods in connection with the grounded wire seems to us an important factor in the situation, particularly if combined with a high factor of safety in the general line insulation. This of itself is a considerable protection, especially in case of the minor lightning discharges which form the vast majority of the total number. The difference between the breakdown voltage of an insulator and the maximum normal voltage on the line measures the applied extra voltage necessary to produce failure. If this difference amounts to 50,000 or 75,000 volts, as it does sometimes in case of a very high-voltage line, then all minor disturbances will be harmlessly discharged at the nearest arrester, while they might easily break down a 15,000-volt or 20,000-volt line with a correspondingly less margin of resistance. As a matter of experience, very high-voltage lines seem to have less than their share of trouble from lightning, though how far this is due to the cause just mentioned, and how far to the generally better protection given an important system, it is from present data impossible to state. The committee is wisely cautious in recommending new forms of lightning arresters, but has a good word to say for the electrolytic type, especially for station use. It seems to stand a long succession of discharges exceptionally well, though demanding, like other sensitive apparatus, frequent inspection. We earnestly hope that the committee will, as it suggests in closing, outline some definite form of record keeping which will enable a proper co-ordination of data to be attained. The chief difficulty with the whole subject is the scrappy kind of information on which judgments have to be formed.

N. E. L. A. COMMERCIAL SESSIONS.

The commercial work of electric-light companies has certainly been receiving enough attention the past three conventions of the N. E. L. A. to make up for the neglect of this subject in previous years. The commercial sessions this year broke all records in the matter of attendance, interest and number of papers presented. This branch of the business has now apparently passed through the effervescent stage, and settled down to good, hard work. Among the papers of most permanent value and timeliness is that by Mr. E. W. Lloyd, of Chicago, giving load factors and ratios of maximum to connected loads, compiled from the records of thousands of consumers. Such

information has a very important bearing on the making of rates. Heretofore conditions have been largely guessed at by companies in making rates based on the maximum demand of consumers, and every company that aims at an equitable system bases its rates in that way. The company at Chicago is one of the few which could furnish information of value on this subject, because it has made it a practice of installing maximum-demand meters on the services of all direct-current consumers for years. This has given it an opportunity to determine the actual maximum demand of consumers, while the large number of consumers connected to its lines makes available averages which are really worth something as a basis for calculation of power and lighting contracts generally. The whole industry is indebted to Mr. Lloyd for supplying this much-needed information.

Another feature of the commercial program which is gratifying is the testimony by the contract agents of various large companies as to the demonstrated value of illuminating engineering in securing and holding business. This has been realized and urged by us for years, but, owing to the difficulties of rapidly training men and in getting together in simple form the necessary facts and figures for rapid illuminating engineering calculations, it is only within the past year or two that the idea is really beginning to bear fruit in the way of practical returns. The benefits obtained from an illuminating engineering department are very tangible, and of considerable quantity as compared to a few years ago. Another matter of special interest brought out was that progressive central stations have found the tungsten lamp a valuable means of increasing their business, thus disproving the fears of those who anticipated a decrease in revenue due to the decreased consumption of the new lamp. Interest in the electric vehicle as a revenue producer has been revived the last year, and this fact was well shown by the part of the session devoted to this subject.

Convention Generalities.

All the expectations and predictions as to the success of the convention of the National Electric Light Association at Atlantic City were more than fulfilled in a week of useful work, a gathering of over 2000 attendants from all parts of the Union, and a display of earnestness and enthusiasm that augurs well for the discharge of all duties falling to the organization in the future. The exhibit of apparatus was large and varied and tastefully grouped. The entertainments were ample, but not unwisely excessive, and the weather did not become disagreeable till the end of the week. Probably no convention of the year at the famous seaside resort will make a better all around record than did this. President Eglin can look back with laudable pride over a memorable meeting and on a term of unusual merit and achievement, during which he laid the association squarely abreast of its great opportunities. And now he turns over his office and its cares to President Frueauff, in whom the association bids fair to find an executive of zeal and devotion, coupled with Western courage and progressiveness.

The program attempted at the convention was really ambitious, with over 60 papers, many of which, with the discussions, were of a high order. But it is unreasonable to expect that so many efforts can all be of equal or extreme value; in fact, they might well be important inversely as their number. The program committee did splendid work this year, but we submit as a tenable proposition that it would be well to lessen the number of papers and lengthen the time available for discussion. At more than one session the discussion came to an unfortunate end because the time was up, although much was left to be said. It is always a brisk controversy that brings out the facts, and a long, dreary mass of printed platitudes or stale facts, poorly thrown together and "elocuted" to death by poor delivery is not the "best buy" for an association whose members have spent over $100,000 in thus getting together. It costs the association and its attendants at least $5,000 an hour for the time spent in actual sessions, and the problem is to get that money's worth back. It was very satisfactory to see how the convention lived up to schedule, almost every paper and discussion being timed to a second. That is a great economy of time.

Undoubtedly the most notable of all the addresses was that of President Vanderlip, of the National City Bank, at the Public Policy session on Wednesday night. It was in admirable form and temper, sane and sober, making for conservative finance, advocating regulation, yet putting in forceful language all the strong arguments for consolidation of contiguous properties, unified management, and such proper accounting as will provide for depreciation and renewals. The sharp warning with which Mr. Insull followed as to the necessity for the members of the association to stand together against the raiding of their properties must be read in the light of the fact that the public lighting art now needs some $200,000,000 of new capital every year, and the investor is not going to subscribe that amount if fierce competition is to put it in peril or wipe it out. On the other hand, the control of public utilities in any given territory brings with it the obligation or necessity for the best service at the lowest profitable rates; and it can only be held on those terms. That evening session, with two such remarkable addresses, with the oratory of Mr. Graham, the discussion by Messrs. McCarter and Burdett, and the magnificent ovation to Mr. C. A. Coffin before and after his eloquent little speech of reminiscence, will long endure in memory and serve as a landmark in association history.

Determination of the Efficiency, Regulation and Size of Transmission-Conductors.

In the predetermination of a transmission line, however short it may be, there is always some numerical work before the designing engineer in order to arrive at a safe and economical estimate of costs for a given delivery of power, at a given distance, under an assigned voltage and frequency. If the line is long and the power to be delivered is large, much computing work may be necessary in order to feel confident as to the outcome. It is possible to make a mistake in the size of wire, or in its spacing, or in the setting of the towers, which may be very costly to rectify. The article by Dr. Harold Pender, on page 1454 deals with this important part of the transmission-engineer's work. It contains a number of compact formulas for producing the required results with the minimum of calculation, and forms a sequel to the paper on the same gen

eral topic read by the same author before the convention of the American Institute of Electrical Engineers last year. It is interesting to observe that the method of dealing with the electrostatic capacity of the line is that of the Π diagram, which splits the capacity into two equal lumps or condensers, one at each end of the line. This is becoming a favorite method with transmission engineers. The article also comes out bravely for handling line e.m.fs. in kilovolts, and powers in megawatts, which is very sensible procedure.

LIGHTING THE SCHOOL HOUSES.

Considering the very large amount of care and money that is spent on public schools in this country, there is an astonishing amount of ignorance or indifference regarding the proper illumination of these buildings. It should be remembered that the public-school houses in our large cities are quite often utilized for evening classes, so that the question of proper lighting rises to an importance that it would not otherwise have. During the ordinary use of the schools by day, artificial light is only required during a part of the year when the days are very short, and on rare occasions at other seasons when the day is greatly darkened by storms, or in unfavorably located school houses in which the natural light is exceptionally poor. But while artificial light in the day schools is thus commonly needed only for brief periods, it is also true that when such light is needed, it is under the most trying circumstances—that is, just at the time when the natural light is failing and needs to be supplemented. This condition means one of two things: either that the artificial or natural light must be used together, or that the natural light must be shut out and the artificial used exclusively. In the latter case the installation for lighting needs to be in every way as extensive as if it were to be used for a large part of every day. In the former case at least as much light is needed, on account of the notorious difficulty of getting a satisfactorily mixed illumination, partly natural and partly artificial. Just why such a mixture should be so unsatisfactory as it is has perhaps never been fully determined. Possibly the usual difference in color between the natural and artificial lights makes their superposition trying, owing to the different focus of the eye for lights of different colors. Perhaps also the radical difference in direction of the natural and artificial lights, when the two are used together, creates confusion and cross-shadows, thereby making hard work for the eye.

Be this as it may, the lighting installation needs to be quite as effective to supplement artificial light as it does to replace it. In spite of this and in spite of the importance of good light in the rooms where children are working, it is rather rare to find a school house properly equipped for artificial lighting. The effect of improper or insufficient lighting in producing progressive myopia in the youthful eye is too well known to need comment here, so that the danger of such a defect is obvious. The trouble in the ordinary school house comes from three causes, sometimes independently present, sometimes acting in evil concert. First, the light may be altogether insufficient in quantity; second, it may be improperly located with reference to the work, and, third, it may be improperly located with reference to the eye of the victim. Very commonly all three faults co-exist. It is not at all unusual to find a schoolroom with only a single central outlet in the ceiling, for an area of 900 sq. ft. to 1200 sq. ft., and this outlet utilized by a chandelier of from four to six 16-cp lights. It goes without saying that such an equipment violates every requirement of decent lighting. It is insufficient in amount, badly placed with regard to the work on the part of the children, and poorly situated with reference to the eyes of the rest. It is a regrettable fact that the ordinary architect, up to within the past three or four years, has been either absolutely indifferent to or absolutely ignorant of the physiological requirements of artificial lighting, and this is nowhere shown with worse effect than within the schools.

Now, in point of fact, a schoolroom is one of the most difficult of rooms to light properly. It is not the amount of light required which causes the trouble, but the nature of the light with respect to the work. Two foot-candles or 2½ foot-candles properly applied give illumination enough for ordinary work in reading or writing. A little more than this will do no harm in schoolrooms, for the reason that under modern methods of instruction there is a very extensive use of pencil and paper, or ink and paper. The paper is usually bad, pencils inferior, and the pens too fine to give really legible writing, even assuming that the ink is good. Gray pencil marks on muddy paper, or the writing produced by bluish ink on a fine pen, make about the worst possible characters in point of legibility. Also, ordinary school work includes a considerable amount of blackboard instruction, and it is very difficult to find a schoolroom in which many pupils are so located as to be able to read readily from the blackboards, the surfaces of which usually reflect enough light to distribute an unpleasant glare. Hence a schoolroom requires rather more light than a room where ordinary reading or clerical work is going on. Furthermore, the pupils are distributed all over the room, and it is a matter of great difficulty to distribute the lighting units so that cross-shadows may be avoided.

It is a very easy thing to find a place in an ordinary school room where by artificial light one can see from two to six shadows of his pencil point, all fairly well defined and creating optical confusion. Now the remedy for this difficulty is pretty well known at the present time. It consists in placing the outlets for light unsymmetrically with reference to the rows and columns of desks, so there will be a general tendency all over the room toward reception of the light from the rear left direction. This unsymmetrical lighting was independently thrashed out both by committees including oculists in London and in Boston, Mass., but it is very difficult to get a school-house architect—or rather the third acting assistant draftsman to whom such trivial matters as lighting are too generally assigned—to depart from the beautiful symmetry he loves to cherish. Another very common fault is the use of lamps, sometimes even unfrosted lamps, fully exposed to the view, with the customary evil effects. A beginning of reform has already been made in a few cities, and there can be found, by anyone who wishes to study them, very excellent examples of lighting in this and other countries; but on the average it is bad, and will continue to be bad until the school committees realize that the eyes of the children committed to their charge are of more importance than the decorative scheme of the schoolroom or the alleged artistic effects of the lighting fixtures.

Meeting of Association of Car-Lighting Engineers.

The semi-annual meeting of the Association of Car-Lighting Engineers was held in the Engineering Societies Building, New York, on Monday, June 7. The meeting was informal and preliminary to the annual convention of the association, which will be held in Chicago, Oct. 5 to 8. The greater part of the day was devoted to a discussion of standard voltages for train-lighting service; definite action on which subject is expected to be taken at the annual meeting. Experiences with the low-voltage tungsten lamp in train-lighting service were also given and from the trend of the discussion it would appear that the tungsten lamp will displace all others for this service. A committee on standard accounts, one on specifications and another on standards were appointed to report at the annual meeting. An interesting discussion took place on the merits of chain drive for axle equipments in preference to belt drive, and it was shown that the chain drive had withstood hard service in the West where belts had failed. The chief troubles with belt drive were found in winter and because of the tension maintained, the bearings on the pulley end of the generators wore rapidly, subjecting the commutator and winding to rubbing action against the brush holders and pole pieces. On the question of theft of tungsten lamps it was brought out that the lamp not being applicable to 110-volt circuits was of little use to the average consumer of electricity and that many companies, notably the Pennsylvania Railroad Company, use lock sockets. With the advent of an improved shade holder the use of shades on lamps is becoming more general. The rattling of the shades in their holders because of the flimsy construction of the latter caused so much complaint from passengers in sleepers that shades had to be discontinued until a better holder was forthcoming. This led to the use of husks and bare lamps which were objectionable. Greater attention is being given to the subject of illumination and the proper distribution of light in railroad coaches and Pullman cars on nearly all the roads, and it was suggested that where possible the members of the association visit some laboratory where tests can be made of lighting equipment with instruments suitable for that purpose. The officers of the association are as follows: President, Mr. A. J. Farrelly; vice-president, Mr. A. J. Collett; second vice-president, Mr. C. W. Bender, and secretary, Mr. G. B. Colegrove.

Meeting of the Railway Signal Association.

The regular stated meeting of the Railway Signal Association was held in the Engineering Societies Building, New York, on Tuesday, June 8. At the morning session the reports of the various standing and special committees were presented and a paper entitled "The Semaphore Arm," by Mr. C. H. Morrison, of the New York, New Haven & Hartford Railroad, was read and discussed. The afternoon session was devoted to the reading and consideration of a paper by Mr. W. K. Howe, of the General Railway Signal Company, on "Alternating Current for Railway Signaling." The association's annual convention will be held this year on Oct. 12, 13 and 14. Louisville, Ky., has been chosen as the meeting place and the Hotel Seelbach as the convention headquarters. The officers of the association are as follows: President, Mr. L. R. Causen; vice-presidents, Messrs. H. S. Balliet and C. E. Denney; secretary-treasurer, Mr. C. C. Rosenberg, *Times* Building, Bethlehem, Pa.

Prize Competition for Design of Ornamental Poles.

The Engineers' Society of Pennsylvania, which has an established fund to provide prizes for meritorious designs of engineering structures, has instituted a competition for the best design of ornamental poles for the support of lights and trolley wires. Plans, specifications and estimates of cost must be submitted. The competition is to close July 15, when the designs submitted will be opened by the board of award. Information in detail may be obtained from Mr. Paul A. Cuenot, chairman, prize committee, Engineers' Society of Pennsylvania, Harrisburg, Pa.

Ohio Electric Light Convention.

The sixteenth annual convention of the Ohio Electric Light Association will be held at Toledo, Tuesday to Thursday, July 13-15. Following is a list of the topics which will form the subjects of papers and discussions: Residential Lighting; Supply of Electricity to Other Towns from a Centrally Located Station; Engine-Room Management; Commercial Organization of Electric Lighting Companies and Their Relation to the Public; Boiler-Room Economy; Factors to be Considered in Making Street Lighting Contracts; Plans to be Followed in Supplying Lamps to Consumers; The Titanium Arc Lamp; Tungsten Lamp Experience.

The entertainment features of the convention will be more extensive than ever before, and will include the following rides, visits, etc.: Tuesday—Auto ride for the ladies; for all, a trip to the Casino, with 6 o'clock dinner and theater party. Wednesday—Trip to Fort Meigs for the ladies; for all, a trip to Toledo Beach, with frog-leg dinner and ball. Thursday Afternoon—Trip to Cedar Point, Ohio, with banquet, lagoon ride and ball in the evening. Transportation in the city and to Cedar Point, and the dinners, banquets, rides, balls and all other features of the entertainment will be free to all attending.

The association has provided an exhibit room, 40 x 70, in the Hotel Boody for the free use of associate members and others desiring to make an exhibit. Ample supply of single-phase, 60-cycle current will be available in the exhibit room, the voltage being 115 and 230. If the demand justifies, the electric light company will supply three-phase currents at the same voltage. D. L. Gaskill, of Greenville, Ohio, is secretary.

Reversal of Revocation of Foreign Patent in Great Britain.

As noted in these columns several months ago, the British Comptroller of Patents revoked certain patents on a flaming-arc lamp on the grounds that the said lamp was not manufactured to an adequate extent in Great Britain. In an appeal brought before a higher court this decision was reversed on the ground that the company had been, and was still making, a bona fide attempt to establish an industry for flaming-arc lamps, and that it had expended large sums with that object in view. The court believed that it was by no means easy to establish a new industry in the teeth of great competition, and it was satisfied that the company in suit was using its best endeavors to fulfil its obligations under the patent act, and that its want of success up to the present was due to circumstances over which it had no control.

Maclaurin Inaugurated at Boston "Tech."

Dr. Richard Cockburn Maclaurin was formally inaugurated president of the Massachusetts Institute of Technology at Symphony Hall, Boston, on June 7, in the presence of a large and distinguished gathering, including the Right Honorable James Bryce, Ambassador from Great Britain; Governor Draper, of Massachusetts; President A. Lawrence Lowell, of Harvard University; ex-President Henry S. Pritchett, head of the Carnegie Foundation; Chairman Arthur A. Noyes, of the faculty; Hon. Frederick P. Fish, former president of the American Bell Telephone Company; Mr. James P. Munroe, former president of the Alumni Association; Dr. A. E. Kennelly, of Harvard, and many other public officials and professional men. The addresses emphasized the great value of broad professional education in modern industry and pointed out the growth and prospects of the Institute as a center of progress in the training of the engineer.

Vanderlip on Electrical Securities.

One of the noteworthy features of the evening session of the National Electric Light Association at the Atlantic City convention on June 2 was the address of Mr. Frank A. Vanderlip, president of the National City Bank of New York City, whose subject was "Electrical Securities." Owing to Mr. Vanderlip's prominence as a financier the closest attention was given to his address by the large and representative audience of electrical men present.

The speaker discussed the attitude of investors toward electrical securities and said that in building new plants, in extending existing businesses, the question of financing was more fundamental than technical means. It is only by the creation of corporation securities that great enterprises can be developed.

Electric-lighting plants are among the newest of the enterprises brought before investors. Even as late as five years ago it was hard to find a market for central station securities, except in a few cases of large companies, because of the newness of the business and the fact that many of the factors connected with it were not sufficiently known and established to attract investment houses. Even at the present time but a comparatively small number of such securities are listed by large financial houses. The reasons for this state of affairs in the past are obvious. The rapid change and improvement in electrical apparatus and methods the first few years brought about changed conditions for the investor and caused a rapid throwing out of obsolete apparatus to make way for new and better. Companies using overhead distributing systems entirely were open at any time to competition which would impair the value of their securities.

These difficulties are now being removed. In the case of companies who have constructed extensive underground systems competitive companies will be slow about entering the field. Another tendency of the times which is helping to safeguard these investments is that of allowing one company to have a monopoly of the field and to regulate that monopoly rather than to attempt to regulate it by allowing competition as in former days. Funds for electrical development are now obtainable with greater ease and at lower rates than have prevailed heretofore.

Mr. Vanderlip emphasized the importance of having a security easily marketable if it is to be attractive to the investor, and to have a security marketable it must be well known. With many small companies it is impossible to have the character of their securities generally known to the investing public. The average investment of electric-light companies of the country in 1907 was about $200,000. The consolidation of a number of small companies gives a security and stability not otherwise possible and the securities will become more generally known and more marketable.

Among the conditions which Mr. Vanderlip outlined as being necessary to make the security attractive to the general investing public were the following:

The company should earn at least twice its interest charges over operating expenses, maintenance and depreciation. The depreciation fund should be in some equivalent of cash.

It should serve a population of 50,000 or over.

The securities should, in the main, net the investor 5 per cent.

Expenditures that should go under operating expenses should not be charged to renewals. The careful bond buyer will analyze accounts rigidly to ascertain that the temptation to do this has been resisted.

If the plant is modern, with reasonable rates, and if the conditions mentioned are met, a security will be created that will be in many ways attractive. If, in addition, the security is large enough to secure marketability, a bond will result that will compare favorably with any other returning a similar rate of interest.

Mr. Vanderlip advocated the combining of small companies into large ones for economic reasons. The diversity of location and operating conditions of the small companies making up the combination gives strength to the whole. In his opinion the most important development of the next few years in the electric light and power field will be in the building of water-power plants and steam plants at the coal mines to generate electricity economically and to distribute it over large areas. Large corporation issues based on this development should be satisfactory to security holders.

The public is coming to recognize that competition between public utilities is bad and the tendency is now in the direction of allowing a monopoly of the business to one company in a community and regulating that monopoly in the public interest. Some have feared that regulation by commission may be carried to the point where the control of a property would be practically taken out of the hands of its owners and managers. Personally, however, the speaker has no fears that this will occur. The public generally is willing to accord capital a fair return and to allow private enterprise as much chance to take the initiative as possible. The public service commission which insists on good service at reasonable rates on the one hand, and on the other hand prevents the piratical attack of competitors, will in the end prove a bulwark to the security holder.

A business which doubles every five years, as the electric-lighting business has done, has in it vitality that is bound to carry it to enormous proportions. Given intelligent management, conservative accounting and fair rates which do not invite legislative attack, funds should be found in ample supply for financing the business. If the economies of corporate combinations are added, with single issues of large volume, then funds should be had for electrical development not only in ample supply, but at a moderate rate of interest.

Protection Against Theft of Electricity.

The Colorado Legislature has passed an act for the punishment of any person who makes any connection with any electric wire without the knowledge and consent of the owner thereof, or who wilfully injures, or interferes with the installation or operation of any electric meter. The penalty attached is a fine of from $50 to $300 and imprisonment of from 30 to 90 days, or both.

The act prescribes that any person who connects or changes any wire, cord, socket, motor or other instrument, device or contrivance, with any wire transmitting or supplying, or intended to transmit or supply electricity to any house, store or other building, without the knowledge and consent of the person or corporation owning said wire, in such manner that any portion of such electricity may be transmitted or supplied to any globe, lamp, heating apparatus or other instrument by or at which electricity is consumed, shall be deemed guilty of a misdemeanor and punished as above specified. Or any person who connects or changes any wire, cord, socket, motor or other instrument, device or contrivance with any wire, transmitting or supplying or intended to transmit or supply electricity to any house, store or other building, without the knowledge and consent of the person or corporation owning said wire, in such manner as to transmit or supply any such electricity to any globe, lamp, heating apparatus or other instrument by or at which electricity is consumed, around or without passing through the meter provided for measuring or registering the amount or quantity of electricity passing through it, shall be deemed guilty of a misdemeanor and similarly punished. Or any person who wilfully injures, alters or by any instrument, device or contrivance in any manner interferes with or obstructs the action or operation of any meter made or provided for measuring or registering the amount or quantity of electricity passing through it, without the knowledge and consent of the person or corporation owning said meter, shall be deemed guilty of a misdemeanor and similarly punished. Proof of the existence of any wire connection, or of any injury, alteration or obstruction of a meter, shall be taken as prima facie evidence of the guilt of the person in possession of the premises where such connection, injury, alteration or obstruction is proved to exist.

New Officers of the A. I. E. E.

The June issue of the *Proceedings* of the American Institute of Electrical Engineers announces the election at the May meeting of the following named officers for the ensuing year: President, Mr. Lewis B. Stillwell; vice-presidents, Messrs. John J. Carty, Paul M. Lincoln and Paul Spencer; managers, Messrs. A. W. Berresford, W. S. Murray, H. H. Norris and S. D. Sprong; treasurer, Mr. George A. Hamilton; secretary, Mr. Ralph W. Pope. The total recorded membership of the Institute on April 30 was 6400, a net increase of 726 for the year.

A. I. E. E. Frontenac Convention.

The current issue of the *Proceedings* of the American Institute of Electrical Engineers contains the final program for the annual Institute convention to be held at Frontenac, Thousand Isles, June 28 to July 1. The preliminary program as printed in our issue of May 6 has been lengthened by the addition of the following titles of papers:

"Method of Testing Transformer Core Losses by Giving Line-Wave Results on Commercial Circuits," by Mr. L. W. Chubb. "Testing Transformer Steel," by Messrs. M. G. Lloyd and J. V. S. Fisher. "The Current Locus of the Single-Phase Induction Motor," by Prof. A. S. Langsdorf. "Output and Regulation in Long-Distance Lines," by Mr. P. H. Thomas. "Corona Phenomena in Air and Oils and Their Relation to Transformer Design," by Messrs. W. S. Moody and G. Faccioli. "Surges on Cable Systems with Aluminum-Cell Protection," by Messrs. E. E. F. Creighton and S. D. Sprong. "Split-Pole Converters and Storage-Battery Regulator," by Mr. J. L. Woodbridge. "Function of Flywheel in Connection with Electrically Operated Rolling Mills," by Mr. H. C. Specht. "Alternating-Current vs. Direct-Current Motors in Steel Mills," by Mr. K. A. Pauly. "Rolling-Mill Motors," by Mr. E. W. Yearsley. "Electrically Driven Rolling Mills," by Mr. E. Friedlander. "Power Requirements for Rolling High-Carbon Steel of Small Sections," by Mr. B. Wiley. "Electrical Control for Rolling-Mill Motors," by Mr. C. T. Henderson. "Calculation of Iron Losses in Dynamo-Electric Machines," by Mr. I. E. Hanssen. "E.M.F. Wave-Shape in Alternators," by Prof. C. A. Adams. "The Modern Telephone Cable," by Mr. F. B. Jewett. "The Education of the Electrical Engineer," by Mr. C. R. Dooley. "The Value of the Classics in Engineering Education," by Dr. C. P. Steinmetz.

The convention committee announces the following social functions:

No entertainment has been planned for Monday afternoon, but boating, fishing, golf, croquet and other outdoor pastimes will be available for those wishing to make use of them. On Monday evening there will be a reception and dance at the Hotel Frontenac.

On Tuesday afternoon there will be a qualifying round in a handicap golf tournament. The first eight will qualify for the semi-finals. There will also be a women's "putting" contest, accompanied by first, second and third prizes. Tuesday evening there will be a women's bridge tournament.

Wednesday morning there will be a daylight excursion for women through the Thousand Islands on a large steamer. The semi-finals of the golf match and a driving contest will be held Wednesday afternoon. Wednesday evening there will be a searchlight trip of 50 miles among the islands on a large boat for both men and women. The finals of the golf tournament will take place Thursday afternoon.

It is proposed to have available a number of launches, which can take small parties around through the islands, these parties to be made up by the individuals wishing to take advantage of them. Golf will be available for men and women at any time, as the golf links are adjacent to the hotel and readily accessible.

Owing to the restrictions now incident to the granting of reduced railroad rates on the certificate plan and the cheapness of excursion tickets to the Thousand Isles, no steps will be taken to arrange for special convention rates of transportation.

Producer Gas from Texas Lignite.

It is now confidently expected that the vast lignite coal resources of the State of Texas will be made many times more valuable than at present through the adoption of a process which has recently been the subject of study at the Pittsburgh experiment station of the United States Geological Survey, the lignite used for the purpose being furnished by Texas mines. The manufacture of briquettes from lignite coal had been extensively tried in Texas, but never proved successful. It was in the making of briquettes that the experiments at Pittsburgh were devoted. Until lately the trouble has been that it was necessary to put something with the lignite to form a binder after forcing out the moisture and taking away the by-products. The average grade of lignite contains about 35 per cent of moisture. In the manufacture of briquettes, the process which the Government experts have just perfected calls for the use of a certain heat and pressure which extract about 70 per cent of the moisture, leaving the tar, or pitch, as a binder. In this way the necessity of adding something to agglomerate the fuel is obviated.

The lignite fields of Texas extend from Texarkana to Laredo, in a zigzag course across the State. The beds are practically inexhaustible. Mines are being worked at Lytle, Rockdale, Bastrop, Bear Grass, Evansville, Crockett and Alba. Excellent results are obtained in the manufacture of producer gas from lignite, and it is claimed that such gas makes the best fuel now known, although it is not an illuminant. In the experiments in the manufacture of producer gas from lignite the Government experts discovered a number of by-products. One of these is ammonia, which can be derived in such large quantities that Texans claim it will not be long until their State will be producing enough of that product to supply the world.

Some of the largest producer gas engines in the world are already in operation in Texas. It is stated that the largest lignite producer gas plant in the world is that of a cement company at Dallas. With this gas the company runs a 4800-hp engine. It is such a success that another large cement company in the same section is installing a still larger plant. In San Antonio a lignite producer-gas plant is able to run a 2500-hp engine.

Exclusive Telephone Service and Common Carriers.

The Indiana Railroad Commission, having been asked as to right of a common carrier to give the exclusive use of its baggage-room telephone to one patron, replied that so far as a railroad is concerned, there would seem to be no impropriety in so doing, provided it were willing to accord the same privilege to any other person who desired to install a telephone in its baggage-room. The commission says the question is a novel and interesting one, so far as relates to the duties of the telephone company, and seriously doubts whether the company could lawfully agree to refuse to call the baggage-room except when the installing concern asked to be connected. The general rule is that a telephone company must serve all its customers equally, affording to all patrons the same facilities for intercommunication. If it were permissible for a telephone company to give to one member of the public the right to call a larger number of places than it gives to another patron, there would seem to be a discrimination inconsistent with its public duties.

Electrification of Railroad Terminals.

Mr. H. H. Evans, secretary and engineer for the local transportation committee of the Chicago City Council, spoke on "The Electrification of Local Railroad Terminals" at the meeting of the Electric Club, of Chicago, on May 26. He referred first to the interest of the city authorities in the subject. The city of Chicago has conducted a campaign to abolish the needless production of smoke, and among other things attention has been drawn to the railroads because of their large contribution to the smoke nuisance. Since the successful electrification of the New York terminal of the New York Central Railroad there has seemed to be no reason why a similar system could not be applied to such of the steam railroads in Chicago as carry a heavy burden of suburban passenger traffic.

The speaker sketched the progress of the agitation in Chicago for the electrification of railroad terminals and said that investigation revealed the fact not only that the experimental stage had been passed, but that the newer method has many advantages both for the public and for the railroads, affording opportunities for economies which, with sufficient density of traffic, may be almost compelling. For the public there is greater comfort and convenience with an absence of smoke, odor, dust, cinders and much noise. This improvement applies both to those who travel on the railroads and to those who live near them.

To relieve congested central districts in large cities existing steam railroads may be utilized for suburban passenger service by electrically equipping them. These existing roads can be utilized in this way at a fraction of the cost of building new elevated railways or subways. These electrified roads should not compete with the local surface lines, but should be used in conjunction with the latter, supplying express service which is not now to be had, or exists only in insufficient degree.

To the railroad electrification offers opportunity for economies in various directions. The absence of smoke, noxious gases and dirt will lengthen the life of equipment; the equipment may be worked to greater capacity; long trains in rush hours and short trains in slack hours may be hauled at nearly equal economy per seat-mile. During the middle of the day short trains at frequent intervals may be substituted for long ones at infrequent intervals at the same gross cost and to the satisfaction of the traveling public and a consequent increase of receipts. Repair bills will apparently be less per train-mile, and there will be some saving in train labor.

But the satisfaction of the public is the most important consideration of all. The electrification of steam roads doing a suburban business in cities should be made with the purpose of making money rather than saving money. Electrification holds great opportunities for increasing patronage. Speaking particularly of the Illinois Central suburban service in Chicago, Mr. Evans said that this service offered good possibilities for electrification. The suburban traffic of this company in Chicago appears to be falling off by reason of the competition of the electrically operated South Side Elevated Railway, particularly since the completion of the Kenwood branch of the latter. The Illinois Central suburban service in Chicago represents about 6500 train-miles daily, and it is estimated that a power plant of about 12,000 hp will be necessary to provide electricity to operate it. It is probable, however, that the company can buy electrical energy as cheaply as it can make it. The local transportation committee has estimated that the cost of electrification with cheap construction would be $4,000,000 without a power plant. It is figured that a saving of $420,000 a year could be effected. The Illinois Central Railroad Company is working with the city of Chicago in the matter and making exhaustive studies of the electrification problem. The handling of freight trains and possible extensions of the suburban service complicate the situation, but electrification must finally come.

The speaker reviewed at some length existing electrifications of former steam railroads both in this country and Europe, giving the characteristics of the various systems employed. One interesting statement was to the effect that in an electrification extending out of Milan, Italy, it had been proposed to install a portable storage battery on a freight train, available for transportation to the scene of a disabled substation should necessity require. Mr. Evans was not sure, however, that this proposal had ever actually been carried out in practice.

Decision of Massachusetts Commission in Leominster Electric Rate Case.

The Massachusetts Gas and Electric Light Commission has issued a decision recommending a slight reduction in rates in the complaint case of the Leominster Selectmen against the Leominster Electric Light & Power Company. The previous net rates of the company for lighting varied from 18 cents to 10 cents per kw-hour, according as the consumption was less than 50 or over 499 kw-hours per month. The net rates for power varied from 6.7 cents per kw-hour below 100 kw-hour per month to 2.9 cents per unit for 5000 kw-hours and over, with a service charge for motors of approximately $1 per horsepower per month. Prior to Jan. 1, 1908, the maximum net rate for lighting was 19 cents per kw-hour.

The company is owned by the Massachusetts Lighting Companies of Boston, and was organized in 1888. Until it came into possession of its present owners in August, 1905, it paid dividends in only two years. Dividends have been paid in every year since June 30, 1905, although in the fiscal year ending June 30, 1908, there was no dividend earned. During the same period the present owners have expended about $60,000 in plant additions and improvements.

The board in its decision discusses at length the matter of its authority to order a reduction in the price of electrical energy supplied for power, and concluded that it possesses such authority. It is doubtful, however, whether the board should concern itself with the determination of any other than a fair price at which the company is bound to supply electricity to anyone who may apply for whatever use. If necessary to make differentials under exceptional circumstances, these should be made upon the initiative of the company rather than of the board. Such differentials are not to be justified merely by the size of the customer's bill; they should not be allowed except where business is not otherwise obtainable; they should be uniform to all persons for a like service; the price should never be unnecessarily low, and should always be high enough to avoid loss to the company. Referring to the company's list of differential rates, this is said to be long, and to vary slightly from step to step. At the time of the hearing no serious attempt was made by the company to show that these rates were designed to attract and develop a business not otherwise obtainable, or to increase the efficiency of the plant.

Referring to the fact that in the last fiscal year the company earned nothing for dividends, it is stated that the reduction of profits was almost identical in amount with the loss of income from the power business of the company, and that it may be fairly assumed that this loss was due to the general business depression, which affected Leominster in a marked degree. With the improvement of business, now well under way, there is every reason to believe that the company's profits will equal, if they do not exceed, those of any previous year.

The prices for street lights have been $72 a year for arc lamps of normal 1200 cp, burning on moonlight schedule until 1 a. m.; $110 for similar lamps burning all night every night; $16 a year for incandescent lamps of 25 cp, burning on moonlight schedule until 1 a. m. The contract at these rates having expired, in negotiations for a new contract the company offered to supply these lights at $120 for all-night arcs; $83.50 for 1-o'clock arcs, and $18.50 for incandescents. The final recommendation of the board is that on and after June 1 the net price charged by the Leominster Electric Light & Power Company for electricity shall not exceed 16 cents per kw-hour; that the price of street lights shall remain as at present, except for 1200-cp arcs burning all night and every night; the charge for which shall be $105 per lamp per year instead of $110.

Chicago Street Railway Rehabilitation.

Another of the successful joint meetings of the Electrical Section of the Western Society of Engineers and the Chicago branch of the American Institute of Electrical Engineers was held at the rooms of the former in Chicago on the evening of May 28. Mr. W. L. Abbott, president of the Institute branch, was in the chair early in the evening, later yielding to Mr. W. B. Jackson, president of the Electrical Section of the Western Society. The subject of the evening was the important work now under way in reconstructing the surface street railway systems of Chicago, and the principal speakers were members of the Board of Supervising Engineers which has the work in charge.

Mr. Bion J. Arnold, chairman and chief engineer of the Board of Supervising Engineers, was the first speaker. He gave a brief outline history of the complicated traction controversy in Chicago which, after 10 years of agitation, culminated in the adoption of the traction settlement ordinances two years ago. He also gave a summary of the provisions of these ordinances and sketched the work of the Board of Supervising Engineers in putting these requirements into effect. The board consists of one engineer representing the city, one representing each company and one independent engineer (Mr. Arnold) representing neither nor both. It is arranged that each of the company members of the board shall have one full vote on matters exclusively referring to that company, the other not voting; but on matters where both of the companies are interested each company engineer has one-half vote. By this means there is always one city vote, one company vote and the vote of the chairman in this board of four members.

The valuation set on the street railway properties of the two principal companies at the time of the settlement was $50,000,000. Since then the rehabilitation has cost about $30,000,000. The expenditure of this money is certified to the board from time to time. It is assumed that the street railways may be maintained for 85 per cent of the first cost. A fund representing 8 per cent of the value of the new work is set aside from the operating receipts for renewals and depreciation. By this arrangement, according to the provisions of the ordinances, the city may purchase at certain predetermined times street railways which shall either be in good operating condition, or, if they are in poor condition, there will be money enough in the renewals fund to make them good. After all expenses are deducted and these are carefully enumerated in the ordinance, 55 per cent of the net receipts are turned into the city treasury, the companies retaining 45 per cent. As the rehabilitation goes on engineers inspect the actual construction work done and simultaneously auditors examine the bookkeeping accounts for that work. The work accomplished and the amount charged for that work must agree.

Mr. H. B. Fleming, representing the Chicago City Railway Company on the Board of Supervising Engineers, spoke on street railway car-house design and operation. He described a modern car house, such as has been approved by the board. The principal lighting is furnished by arc lamps wired five in series on 500-volt circuits. In the pits underneath the cars incandescent lights are used. Electric energy is used for operating tools and other machinery, and the power circuits are controlled from a switch room with direct access from the street, which may be used in case of fire to cut off the current. One interesting statement made by Mr. Fleming was that with the adoption of the improved design of car houses the Chicago City Railway Company's rate for insurance in the year 1909 was just one-half that prevailing in the year 1906, three years before.

Mr. John Z. Murphy, representing the Chicago Railways Company on the board, was not present, but, in his absence, Mr. Abbott paid a tribute to his ability as an engineer.

Mr. George Weston, representing the city of Chicago on the Board of Supervising Engineers, supplementing Mr. Arnold's remarks, gave a brief outline of the ordinance requirements for the rehabilitation of the properties and also an account of the work of the Board of Supervising Engineers in supervising and inspecting the enterprise. The work of the board is divided into divisions each in charge of a division engineer, and these divisions have to do, respectively, with tracks and roadway, electric power distribution, buildings and fixtures, power plant equipment, cars and car operation, tunnels and subways, drafting and accounts. The force under the direction of the board embraces 137 persons.

On June 17, 1907, actual track rehabilitation was begun. The railway feeders are placed underground in an area of about 40 square miles in the central portion of Chicago, and here about 6,500,000 duct-feet of conduit have been laid. Three types of track construction are used, differing principally as to foundations. The Chicago City Railway Company has completed about 98 per cent of the track reconstruction assigned to it, and the Chicago Railways Company has about 68 per cent of its work of this character to its credit. All new rails are made of open-hearth steel. The single-duct, square-bore conduit is standard for all classes of underground work. In overhead construction the maximum drop in voltage permitted in heavy-traffic sections is 50 volts.

Four new car houses are now under construction by the Chicago Railways Company, and the Chicago City Railway Company has a like number, counting those built and under construction. The Chicago City Railway Company buys practically all of its electrical energy from the Commonwealth Edison Company, and the Chicago Railways Company takes a large proportion of its power from the same source. The substations in which this electricity, bought "in bulk," is made available for use in railway operation are good examples of modern high-class engineering practice. Mr. Weston gave some details on the pay-as-you-enter cars which are in use in Chicago under the board's authority, and made the interesting statement that 50 all-steel cars will be in operation on the streets of Chicago within the next two months.

Before the discussion was begun there was a show of hands to determine the relative number of members of the two societies in attendance, and the count showed that there were 70 gentlemen present from the Institute and 44 from the Western Society of Engineers. Of these 16 are members of both societies.

Mr. B. I. Budd, general manager of the Metropolitan West Side Elevated Railway Company, asked if the track capacity in the center of the city had been nearly reached in the case of the surface railways.

Mr. Arnold answered to the effect that when the tracks are all reconstructed "downtown," the cars will be through-routed as far as possible, and it is believed that this expedient will relieve the congestion greatly by doing away with "downtown" loops. Single cars will be operated instead of trains of two cars or possibly more, as has been the case in past years. This also will tend to relieve congestion. A further source of relief is the fact that the new cars have more powerful equipments, increasing the speed of acceleration about 11 per cent as compared with the older cars. However, Mr. Arnold remarked that all space on the streets, under the streets and apparently above them would be needed to carry the traffic of Chicago in the years to come.

Mr. P. Junkersfeld, electrical engineer for the Commonwealth Edison Company, referred briefly to the manner in which his company supplies electrical energy for a large proportion of the railway operation in Chicago. Other participants in the discussion were Mr. E. M. Lake, division engineer for electric power distribution for the Board of Supervising Engineers, and Mr. D. W. Roper, assistant chief operating engineer of the Commonwealth Edison Company.

Answering questions and closing the discussion, Mr. Arnold said that since the ordinances have been in operation the companies, under the law, have paid into the treasury of the city of Chicago nearly $3,000,000 as the city's 55 per cent of the net profit. This sum is approximately 8 per cent of the gross receipts of the companies. During the progress of the

studies and investigations on which the ordinances were based some of the representatives of the city expressed the belief that the city should be guaranteed at least 10 per cent of the gross receipts, but Mr. Arnold found that it would be impracticable to give this guarantee and at the same time build such high-class substantial railway systems as the city should have. It is probable that the city's percentage of the gross receipts during the 20 years is about 8 per cent.

Mr. Arnold also said that he was inclined to the belief that, in general, in making settlements of this character between municipal corporations and public-service companies, promotion charges, legal expenses and the like should be put into a fund to be charged off through a series of years so that eventually this expense may not be a burden on the capitalization.

Meeting of Boston Section, A. I. E. E.

The May meeting of the Boston section of the American Institute of Electrical Engineers was held at the Edison Building on the evening of the 19th. An address, entitled "Demonstrations of Lightning Phenomena," was given by Mr. E. E. F. Creighton, of the General Electric Company, Schenectady, who also set forth the advantages of the electrolytic lightning arrester. The following officers were elected for the ensuing year: Chairman, Prof. D. C. Jackson; vice-chairman, Mr. John W. Corning; secretary and treasurer, Mr. A. L. Pearson. Executive committee: Messrs. J. F. Vaughan, N. J. Neill, L. L. Elden, M. V. Ayres and G. W. Palmer, Jr.

Domestic Production of Mica.

According to the figures reported by D. B. Sterrett, of the United States Geological Survey, the total production of mica in the United States in the year 1908 amounted in value to $267,925. The production of sheet mica amounted to 972,964 lb., valued at $234,021, which was a decrease of 87,218 lb., or $115,290, from 1907. The production of scrap mica amounted to 2417 short tons, valued at $33,904, a decrease of 608 tons, or $8,896 in value from 1907. The value of the imports to the United States fell from $925,259 to $266,058, due to the restricted electrical manufacturing output of the period. The imports for the past year were thus slightly less than the domestic production, although in years previous the imports had been several times greater than the domestic output. The mica produced in this country came from 10 States, the most important of which in the order of value were North Carolina, South Dakota, Colorado, Alabama and Virginia.

Massachusetts Legislative Notes.

The bill to authorize the Metropolitan Water and Sewerage Board to sell or lease certain land for the transmission of electricity has been passed by both branches and laid before Governor Draper. If it is approved it will facilitate the entrance of Connecticut River power into the State. The engrossed bill to authorize the town of Framingham to procure and use electricity for certain municipal purposes has been amended by the restriction of any erection of poles or wires, fixtures or apparatus upon State lands. The bill providing for the issue of additional capital stock by gas and electric light companies has been passed by the House and sent to the Senate.

New York Public Service Commission News.

The Board of Estimate of the city of New York has approved the application of the Hudson & Manhattan Railroad for a franchise to extend its lines under Sixth Avenue to the Grand Central Station at Forty-second Street and Park Avenue. Mr. McAdoo, president of the company, promises that work will be begun on the line as soon as sufficient consents of property owners can be secured, and he hopes to have the road ready for operation by the spring of 1911.

The Public Commission of the First District of New York has made a requisition upon the Board of Estimate for an appropriation of $1,500,000 for the purpose of lengthening the platforms of the present subway so that it can accommodate local trains eight cars long and ten-car expresses. This improvement was suggested by the Interborough management, and it is claimed that it will increase the capacity 25 per cent.

The Board of Estimate and Apportionment has approved of the change in plans suggested by the Public Service Commission providing the double decking of the proposed Lexington Avenue and Broadway route. This change was necessary owing to the narrowness of Lexington Avenue, which would not permit of the construction of four tracks on the same level.

The Public Service Commission has ordered the Staten Island Midland Railroad to exchange transfers at a number of points in Staten Island where they have been refused heretofore. The matter was only important to a few residents of the localities affected, but it is taken as a precedent that the commission may order transfers wherever it sees fit.

No bids have yet been filed with the Public Service Commission for the construction of new subways, but it is known that plans are being matured by both the Interborough company and the Bradley-Gaffney-Steers Company for the building of complete systems from the Bronx to Brooklyn.

Process of Making Hard Fiber.

Two patents were issued June 1 to Dr. Willis R. Whitney on a process for application in the manufacture of the insulating material commonly known in the electrical arts as hard fiber. As is well known, this material is somewhat similar to hard rubber in its electrical and mechanical properties, and is used for a great variety of purposes in the electrical arts. In the preparation of the fiber it is customary to treat sheets of cellulose by passing them through a strong solution of chloride of zinc, after which the sheets are piled up one on another and pressed into a homogeneous mass. The zinc chloride is then removed by washing, which is carried on in several distinct steps, as it has been found that if the material is placed directly in pure water, the osmotic pressure of the salt in the pores of the mass will draw in an excess of water and form water-blisters. On this account six weeks of washing by gradual treatment with more and more dilute solutions of the chloride is necessary for sheets of 1 in. or more in thickness, and this greatly increases the cost of the material when made in thick masses. The object of the patent is to improve the method of washing by utilizing as a solvent for the zinc chloride a solution having such a concentration that it will have the same osmotic pressure as the zinc chloride solution to be removed. By mixing a solution of glycerine or glucose in water the fiber mass may be used to wash, thereby removing the zinc chloride, in this way keeping the concentration of the zinc chloride low, and consequently its rate of diffusion from the mass into the wash water very high, the result being to prevent the forming of water-blisters in the fiber. An electric current may be used to increase the velocity of motion of the ions of the salt or impurity. The current causes the motion of zinc to the cathode and of chloride to the anode, and the two elements are thus separated at the electrodes. By a suitable addition of alkali and acid in dilute form to neutralize the products liberated at the electrodes and to preserve the isotonic condition of the washing liquid, the process practically amounts to the replacement of the zinc and chloride within the fiber by the components of the water, namely H and HO ions. The two patents contain 11 claims covering the removal of zinc chloride from cellulose. One of the claims is on a process for removing a solution of metallic salt from an organic material, which consists in washing the said material with a solution relatively high in organic content and relatively low in inorganic content, and still another is on a process of removing zinc chloride from cellulose, which consists in washing said cellulose with a solution having an appreciable osmotic pressure and relatively low zinc chloride content.

Convention of the National Electric Light Association.

General Report of the Proceedings at Atlantic City, N. J., June 1-4, 1909.

FOR the first time in its history the National Electric Light Association at the Atlantic City convention of 1909 passed the 2000 mark in attendance, the exact number registered being 2030, which may be compared with 1788 at the Chicago convention of last year. During the year, under the administration of President W. C. L. Eglin, the association has grown in membership from 1361 to 3215, so that it was not strange, perhaps, that this convention should be the largest in its history. Some, indeed, are so sanguine as to predict a membership of 6000 by the time of the next convention.

The character of the convention was in keeping with its size, the general tone of papers and discussions being distinctly good. There were no less than 57 papers and committee reports, and on Thursday of convention week there were three simultaneous sessions. The convention was held on the Million Dollar Pier at Atlantic City on June 1, 2, 3 and 4, and consisted of general, technical, commercial and accounting sessions. A large amount of data and material was presented at the 12 sessions of the convention. The report and exhibit of the meter committee were particularly complete, while much credit is also due to the members of the gas-engine committee for their personal investigations and report on gas-producer plants. Important action was taken on the subject of the grounding of secondaries, as reported below.

Amendments to the constitution were adopted by which it will be possible to hold national special sessions of men like lawyers, accountants, purchasing agents, commercial men and others who specialize in some department of the industry. Conventions may be held by these sections without necessarily being coincident with the date of the main convention. The commercial papers at Atlantic City were particularly numerous, and in this department of convention activities the discussions on the electric-vehicle situation and on load factors were of timely interest. Large attendance and much interest characterized the accounting sessions also.

A distinguished visitor to the convention was Mr. Frank A. Vanderlip, president of the National City Bank, of New York, who accepted an invitation to address the association on the subject of "Electrical Securities." His address, given in abstract elsewhere in this issue, was of much practical importance to all central-station men who have to solve the inevitable problem of finance.

In presenting the valuable report of the committee on public policy, Mr. Samuel Insull, chairman of that committee, quite overshadowed the interest in the report itself by his supplementary remarks on the "raiding" of electrical securities by electrical manufacturers. This protest, coming from such a source, naturally excited great attention. Other men of prominence in the electrical industry who spoke at the memorable Wednesday evening session were Messrs. C. A. Coffin, president of the General Electric Company; Thomas N. McCarter, president of the Public Service Corporation of New Jersey, and George S. Graham, of Philadelphia.

The entertainment features were not overdone, but were thoroughly enjoyed. Chief interest centered in a baseball game in which a team representing the West defeated one from the East by the close score of eight to seven. This was some alleviation for the defeat of two years ago at Washington, when the East was victorious by a decisive score.

GENERAL VIEW OF RECEPTION ROOM AND EXHIBITION HALL, ATLANTIC CITY CONVENTION.

The general arrangements for the convenience of those attending the convention were carried out in accordance with a carefully arranged plan. The registration booth and secretary's office were at the entrance to the Pier, and here accredited visitors were supplied with one packet containing badge and a book of tickets to entertainments and with others containing convention papers printed in advance. General and technical sessions were held in Marine Hall, farther out on the Pier, while the simultaneous commercial sessions and accounting sessions of Thursday were held in other halls on the Pier. In all three locations the noise of the sea formed an accompaniment to the discussions.

Mr. Frank W. Frueauff, of Denver, was promoted from the office of first vice-president to that of president, and the choice is universally commended. Mr. Frueauff has been active in the affairs of the association for the last year, supplementing the untiring efforts of Mr. Eglin, and has served as chairman of

the general convention committee, so that the honor is well deserved. Mr. W. W. Freeman, of Brooklyn, was elected first vice-president; Mr. John F. Gilchrist, second vice-president, and Mr. Frank M. Tait, of Dayton, secretary and treasurer. The new members of the executive committee are. Messrs. Charles A. Stone, of Boston; Dudley Farrand, of Newark, and H. M. Byllesby, of Chicago.

The convention, with its excellent exhibition of the apparatus of associate members, was most successful in every respect.

STATE AND COMPANY BRANCHES.

Following the presentation of the report of the committee on State and company branches, on Tuesday morning, June 1, as mentioned at the conclusion of the introductory report in the *Electrical World* of last week, there was a discussion of some length. Mr. C. L. Edgar, of Boston, spoke first, advocating State sections rather than company sections. He was followed by Messrs. L. H. Conklin, of Connellsville, Pa., president of the Pennsylvania State association; H. W. Hillman, Grand Rapids, Mich.; S. Fred. Smith, Salem, Mass.; Dudley Farrand, Newark, N. J.; D. B. Rushmore, Schenectady, N. Y.; C. N. Stannard, Denver, Col.; M. S. Seelman, Jr., Brooklyn, N. Y.; B. W. Mendenhall, Salt Lake City; Harold Almert, Chicago; H. Goodwin, Jr., Philadelphia; Mr. Searle, the chairman of the committee; E. F. McCabe, Lewiston, Pa.; E. L. Smith, Towanda, Pa., and John F. Gilchrist, Chicago. All the gentlemen taking part in the discussion were agreed on the general principle of enlarging the scope of the association's work, but there was some divergence of opinion as to the best methods of bringing this result about. On motion of Mr. Frank W. Frueauff, of Denver, the president was instructed to appoint a committee to consider the subject of dues in the State sections. As announced later, this committee consisted of Messrs. W. W. Freeman, of Brooklyn; H. L. Doherty, of New York, and C. L. Edgar, of Boston.

AMENDMENTS TO THE CONSTITUTION.

There was no session on Tuesday afternoon, but on Tuesday evening there was a meeting of three hours' duration devoted mainly to lamps and lighting. Before the papers were taken up, however, Mr. W. W. Freeman offered some amendments to the constitution approved by the executive committee. These amendments relate to some changes in dues and provide for new members of the executive committee, but their principal purpose is to add a new article providing for national special sections of "lawyers, accountants, engineers, purchasing agents commercial men, or of any other class of persons connected with the conduct of the central-station business," subject to the ratification of the executive committee. To be a member of one of these sections a man must also be a member of the National Electric Light Association. It will be possible to hold national section conventions, subject to the approval of the executive committee or the president. The amendments to the constitution were referred to a committee appointed later by President Eglin, and consisting of Messrs. W. W. Freeman, H. L. Doherty, and C. L. Edgar. On Friday the amendments were adopted.

LAMPS AND LIGHTING.

Mr. J. W. Cowles, of Boston, abstracted his paper on "Developments in Street and Park Lighting." The general subject indicated by the title was treated by giving an account of recent developments in various cities, with illustrations. Mr. S. G. Rhodes, of New York, read a written discussion of the paper, and Messrs. Farley Osgood, of Newark; George H. Lukes, of Chicago, and others spoke on the subject.

A valuable report from the lamp committee was presented by Mr. W. W. Freeman, of Brooklyn, chairman of the committee. Mr. P. S. Millar, of New York, opened the discussion and described with the aid of lantern-slide diagrams tests which are now under way on tungsten lamps of foreign and domestic manufacture. These tests have gone far enough to show that the domestic lamps are certainly the equal and probably the superior of foreign lamps. One point of interest is the apparently longer life of 60-watt sizes. Others taking part in the lamp discussion were Messrs. F. W. Willcox, of Harrison, N. J.; Cowles, of Boston; Seelman, of Brooklyn, and Edgar, of Boston. Mr. Cowles made the statement that the cost per lamp delivered by the systematic delivery of Boston was 1.4 cents.

"The Manufacture of Incandescent Lamps" was the subject of the paper presented by Mr. S. E. Doane, of Cleveland, and also bearing the names of Messrs. J. E. Randall and Glen C. Webster as joint authors. Mr. Doane described the methods of lamp manufacture with the aid of pictures taken in a lamp factory and thrown on the screen. He said that the breakage of bulbs in the factory was from 6 to 10 per cent, of filaments from 20 to 30 per cent, and of tubing from 4 to 5 per cent, while there is a loss of 10 per cent on lamps not running to voltage.

An instructive illustrated lecture on the "Quality of Light" was given by Mr. Paul F. Bauder, of Cleveland. The different types of electric and gas incandescent lamps were considered and there were some interesting colored pictures to show color values. Dr. C. P. Steinmetz, of Schenectady, complimented the author of the paper and said that it would be interesting to study luminescent sources of light as well as incandescent sources of light in the matter of color values.

RECENT IMPROVEMENTS IN ELECTRICAL EQUIPMENT.

President Eglin called the third general session of the convention to order promptly at 10 o'clock on Wednesday morning. There was a large attendance from the outset, and the hall was soon filled. The papers of this session reflected the recent progress of the art in equipment, and indicated the probable development of the immediate future in both apparatus and methods. It was apparent that despite the great progress of the past, there is no cessation in the march of progress tending toward new and improved equipment.

The first paper was by Mr. Joseph Appleton, Philadelphia, of the Electric Storage Battery Company, on "Advance Information Regarding Developments in Storage Batteries." The paper was read in abstract by the author, who emphasized the importance of the new Exide plate for central-station service. This plate gives nearly twice the output of the old Manchester plates for double the time, with a higher terminal voltage, and is particularly attractive in stations requiring emergency capacity.

The next paper was on "The Regenerative Flame Lamp," by Mr. A. J. Mitchell, of the Adams-Bagnall Electric Company, Cleveland, who described this new illuminant, giving photometric diagrams and comparisons of its operating costs with those of street and commercial arcs.

The papers of Mr. N. R. Birge, of the General Electric Company, Schenectady, on "The Status of the Arc Lamp" was read by Mr. C. W. Stone, of Schenectady, and this was followed by the paper of Mr. C. E. Stevens, of the Westinghouse Electric & Manufacturing Company, Pitttsburgh, on "Recent Types of Arc Lamps and Their Operation," read by the author.

Dr. C. P. Steinmetz, of the General Electric Company, Schenectady, opened the discussion. He emphasized the progress which has been made by the magnetite lamp in comparison with the regenerative and other types of flaming arcs, and pointed out the importance of proper selection of shades in securing the best results on the street. The most flexible service can be obtained by the use of opal globes, since by modifying the shape of the globe the light distribution can be changed to suit the local requirements. An important additional advantage in the luminous arc is the independence of the size of the electrode on the efficiency of the unit. Larger electrodes can be used without difficulty, and this means better light and longer life. Mr. E. W. Lloyd, of Chicago, stated that the impregnated-carbon lamps did not satisfy the principles of scientific illumination, and are ill adapted for use in buildings with low ceilings. Mr. J. W. Cowles, of Boston, pointed out the value of the magnetite lamps in the solution of street-lighting problems in that city.

The monumental and valuable report of the committee on meters was then presented by Mr. George Ross Green, of Philadelphia, who outlined the scope of this document—a volume of 278 pages, with 67 illustrations—calling attention to the im-

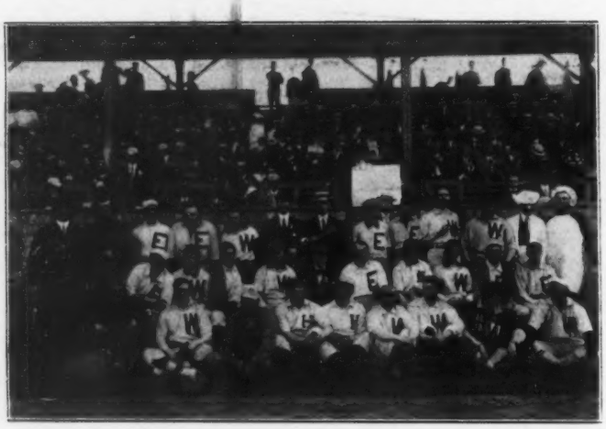
portance of meter maintenance and to the exhibit of the meter committee on the Pier. In discussing the report Mr. J. W. Cowles, of Boston, touched upon the importance of accuracy in meter tests on the system. Mr. C. D. Haskins, Schenectady, praised the work of the committee in preparing this exhaustive pamphlet. Others taking part in the discussion were Mr. J. T. Hutchings, of Rochester, N. Y.; Mr. Eichert, of Brooklyn; Mr. C. G. Durfee, of Rochester, and Mr. Samuel Insull, of Chicago. Mr. Insull spoke of the importance of meter first cost in connection with the use of tungsten lamps in small apartments.

Mr. Torchio, of New York, then presented his paper on "The Future Requirements of Central-Station Companies," which was discussed briefly by Mr. Insull, who pointed out the importance of securing a high-load factor by the combination of different classes of loads upon the station.

The paper of Mr. E. W. Allen, of the General Electric Company, Schenectady, on "Some Recent Developments in Electrical Apparatus," was then read by Mr. Stone, and followed by the paper of Mr. E. G. Reed, of the Westinghouse Electric & Manufacturing Company on "Distributing Transformers as of Interest to Central Stations." These papers were discussed by Mr. W. S. Moody, of Schenectady; Mr. H. W. Peck, Rochester, N. Y.; Mr. Ives, of Poughkeepsie; Mr. D. B. Rushmore, Schenectady, and Mr. M. A. Sammett, Montreal.

THE GREAT BASEBALL GAME.

With all the excitement and much more than the fun of a professional game the baseball championship of the association, for this year at least, was decided on Wednesday afternoon at the Atlantic City grounds in the presence of a thousand electrical "fans." Teams representing the East and the West



BASEBALL TEAMS—EASTERN ELECTRIFIERS AND WESTERN WINNERS AT ATLANTIC CITY.

battled for supremacy, and the West won by a score of 8 to 7. There was every accessory of an everyday league contest, with several others that were never dreamed of in professional baseball. The band of music and the policemen were genuine, but the fantastically attired coaches were costumed in a manner wonderful to behold. The players were in uniform, and every person present was a "rooter" either for the East or the West, red paper carnations distinguishing the West, and that unusual flower, the blue carnation, the East. Conspicuously displayed near third base was a large keg, apparently containing real beer, with a flaring placard announcing that it was presented with the compliments of a brewing company. A "fake" fight created uproarious laughter, and the belligerent "fans" were forcibly removed from the grounds by the police. A fine brass watch concealed in a bouquet of carrots was presented to Manager F. W. Frueauff of the Western team, and Manager F. G. Vaughen, of the Eastern nine, was similarly honored with a two-ounce "sparkler." Messrs. H. L. Doherty and Chas. R. Huntley were honorary umpires, but with rare discretion they did not have much to say, a professional making the actual decisions.

The two teams played to win, and the game was closely contested. The Westerners took the lead at the start, but when the East tied the score in the first half of the fourth inning there was tremendous excitement and cheering. Again the West forged to the front, and again in the seventh the East tied the score in the first half of the inning. Now the feeling ran high indeed, for it had been agreed that the game should be called at the end of the seventh inning. The crowd swarmed on the grounds, and there were continuous shouts of encouragement to the players, which culminated in a roar of cheers for the West when Mr. J. C. Manley, of Chicago, won the game for the Western team by driving in the winning run with his trusty bat. But one accident marred the afternoon's enjoyment, and that was when Mr. L. P. Sawyer, of Cleveland, catcher for the Western team, was forced to retire from the field in Umpire Doherty's automobile with an injured hand. A feature of the game was the batting of Mr. J. E. Davidson, of Montpelier, Vt., for the Eastern nine. The names of the players are as follows:

Effulgent Eastern Electrifiers—Mr. Kennedy, 2b.; Mr. McMaster, ss.; J. E. Hodgson, 3b.; Mr. Agnew, l.f.; A. E. Hitchner, c.; Mr. Garrett, p.; F. E. Vaughen, 1b.; J. E. Davidson, c.f.; R. B. McCreery, r.f.

Windy Western Winners—B. F. Dalgleish, 3b.; J. J. Miley, 2b.; P. S. Dodd, c.f. and c.; R. A. Brooks, 1b.; T. H. Ward, ss.; H. H. Scott, r.f.; J. C. Manley, l.f.; H. H. Cudmore, c. and c.f.; L. P. Sawyer, c.; H. C. Glaze, p.

The score by innings was as follows:

East	0	0	0	2	2	0	3	—7
West	2	0	0	4	1	0	1	—8

SECRETARY AND TREASURER'S REPORT.

At the evening session of Wednesday the report of the secretary and treasurer was presented by Mr. John F. Gilchrist, who said that the main object of the National Electric Light Association may be briefly expressed by the statement that it is to safeguard the many millions of dollars of capital invested in electric light and power industries and undertakings in America. The association includes in its membership representatives of a large percentage of the total investment in the electric light and power field in the United States; but there is still a large number of the smaller companies which are not members. During the year 22 company branches, with membership of over 1500, have been formed. The figures of membership showing growth during the year are as follows:

	1908.	1909.
Class A	680	728
Class B	422	2,152
Class D	166	203
Class E	93	132
Total	1,361	3,215

Three important standing committees were created by President Eglin—lamp committee, finance committee and library committee. The solicitor's hand-book has been edited and published. Secretary Gilchrist particularly commended the work of the meter committee and the public policy committee at this convention and the efficient labors of Miss Harriet Billings, assistant secretary.

ELECTRICAL SECURITIES.

The Wednesday evening session was in some respects the most important of the convention. Following the secretary's report came an address by Mr. Frank A. Vanderlip, president of the National City Bank of New York, which dealt with central-station securities from the viewpoint of the large financier and which was valuable both to the large and small companies represented. Mr. Vanderlip's address, which was brief and to the point, is presented in abstract elsewhere in this issue.

The next speaker was Mr. Thomas N. McCarter, president of the Public Service Corporation of New Jersey, who expressed appreciation of Mr. Vanderlip's courtesy in coming to Atlantic City and addressing the convention. That a man of Mr. Vanderlip's unquestioned eminence in the financial world should appear before the National Electric Light Association convention must be considered cause for greatest congratulation by all its members. As for himself, he thought that the sooner public-service companies get through with high-finance methods

and settle down to hard-pan operation on a steam-railroad basis the better for all.

President Chas. A. Coffin, of the General Electric Company, was then called upon, and his appearance was greeted with much applause. He spoke feelingly of his affection for the men present, all of whom had assisted in building up this great electric lighting and power industry. He had seen it grow from commercial lighting of a few downtown stores and saloons to the supply of nearly all the electric light and power needs of a great community, until no gentleman's home is now complete without at least several applications of electricity in addition to electric light. The assurances of Mr. Vanderlip, he said, should be a vast encouragement to those present. He cited the magnificent examples afforded by the properties built up by President Insull, of the Commonwealth Edison Company of Chicago; President McCarter, of the Public Service Corporation of New Jersey, and President Edgar, of the Edison Electric Illuminating Company of Boston, upon which properties there were millions of dollars in securities all coming within the high standards set up by Mr. Vanderlip. Furthermore, the work which had been carried on in these great centers is now being extended to the small hamlets of the country, which are being interconnected by transmission lines and brought into consolidated distributing systems.

Mr. Samuel Insull, president of the Commonwealth Edison Company of Chicago, said that he had found it easier and easier to get the money with which to finance central-station development each year, thus indicating the improving regard in which securities of this kind are held. He said that if central-station men would only profit by Mr. Vanderlip's address and consolidate their properties so as to both make them more secure and operate them more economically they could get a higher price for their securities or, in other words, would have to pay a less rate of interest.

The trend of the evening's discussion on this subject and of Mr. Vanderlip's address was to bring out the advantages to be gained from a financial point of view by the consolidation of numerous small properties under the ownership of one company.

OTHER ADDRESSES.

This discussion on finances was followed by an address by Mr. George S. Graham, of Philadelphia, on the "Electrical Industry." This was of an oratorical and historical nature, dealing with the development of electric science from the earliest times.

Mr. Everett W. Burdett, of Boston, thanked the speakers of the evening and indulged in some interesting reminiscences of the electrical business. In relation to the official regulation of public-service companies by commission he thought that this regulation had much to do with the present high standing of the securities of the Edison Electric Illuminating Company of Boston. This regulation as carried on in Massachusetts is a safeguard to the investor.

PUBLIC POLICY.

The committee on public policy made its report through its chairman, Mr. Samuel Insull, of Chicago. After reading a part of this report (which is abstracted elsewhere) and giving an outline of the remainder of the volume, Mr. Insull said:

"The only other subject that would seem to be of interest to our members, but which the committee thought it better not to mention in the report, is the signs that are becoming somewhat apparent in different parts of the country, of a tendency on the part of some of the electric manufacturing companies to raid the securities of our member companies by fostering the formation of opposition electric illuminating and power companies. I do not care whether the excuse is made that it is an effort to sell their apparatus, or whether you call it by the term that I have used, 'raiding our securities,' or whether you pick out an uglier name which I will not mention, the fact remains that those who have been in this business for a number of years look with great alarm at any tendency of the manufacturing companies in that direction.

"I first asked the president to consider the public policy report in executive session, but during the speech delivered by Mr. Graham I told him that if he agreed with me I would prefer that it should be considered in public session. My object in suggesting that was that necessarily there are representatives of the manufacturers present and I want them to hear what I have to say. The worst thing that they can possibly do is to start in and try to 'kill the goose that lays the golden egg,' and we happen to be the 'goose.' (Applause.) It has been stated here to-night on good authority that we have invested in our business a billion of dollars. I presume it would be fair to state that there is hardly as mush as one-third of that amount invested in the electric manufacturing business of the country. How is that, Mr. Coffin?"

Mr. Coffin: "About $300,000,000."

Mr. Insull: "I think that is naming a liberal amount. Now, if the investors of that $300,000,000 want to pull the house down over their heads, the best way and the quickest way for them to do it is to pursue a policy in selling their goods which will throw discredit on the billion dollars invested in our side of the business. I am speaking whereof I know. I understand that there is a well-defined plan to start this campaign in as it used to be carried on 20 or 25 years ago in the smaller communities of the country; but they are after larger game. The excuse made is, 'We do it because we cannot sell our goods any other way.' We have had fortunately very little of that kind of thing to deal with lately in the public policy committee. It was a well-defined policy of certain of the electric manufacturing companies 15 or 20 years ago. Many of us know that to our cost. I think that it is only fair that as an organization we should serve notice on some of the gentlemen who are responsible for the operation of several of the large electrical manufacturing companies, and who have not the benefit of the experience of 10 or 15 years ago, that such a course, while it might temporarily affect the values of our securities, must inevitably react on the manufacturing companies and must array against them, whether by organized effort or by spontaneous action, a thousand millions of capital invested in the electric illuminating business in this country. (Applause.)

"I had intended to ask to-night to be relieved of any further connection with the public policy committee, but with the possibility of such a movement coming to a head, I hope that I will have the privilege of serving this association in some capacity in connection with the public policy work during the ensuing year." (Applause.)

NOMINATING COMMITTEE.

The convention then went into executive session and heard the report of its insurance expert, Mr. W. H. Blood, Jr. A nominating committee was elected consisting of Messrs. N. F. Brady, of New York; W. J. Barker, of Denver; S. H. Conklin, of Scranton; C. H. Hodskinson, of Boston, and Charles R. Huntley, of Buffalo.

TECHNICAL SESSIONS.

The first technical session was held on Thursday morning. The president was obliged to leave the meeting soon after it began, and Vice-Chairman W. F. Wells, of Brooklyn, took charge.

In the absence of Chairman J. B. Klumpp, the report of the committee on gas engines was read by Mr. I. E. Moultrop, Boston. This report is an exhaustive document of 114 pages, containing four tables and 37 illustrations bearing upon modern gas-engine practice in a considerable number of installations. Mr. Moultrop reviewed this report and said that in addition to the material printed the committee had secured a large amount of operating data, which will be submitted in a supplementary report at some later time. Those who took part in the discussion were Messrs. M. R. Bump, New York; George R. Stetson, of New Bedford, Mass.; E. F. McCabe, Lewistown, Pa., and Mr. Moultrop. The general opinion was that the gas engine proper is a thoroughly reliable machine when supplied with the proper kind of gas. The producer plant offers the chief source of difficulty at present. Special training is necessary

before a man accustomed to steam-boiler firing can be turned loose into a producer plant.

The next paper, "Some Features of Condenser and Cooling Tower Design and Operation," was read by the author, Mr. M. R. Bump, of New York. It was discussed by Mr. A. R. Cheyney, of Philadelphia, and Mr. H. C. Abell, of New York. The advantages of different types of condensing apparatus were considered at length.

Mr. P. Junkersfeld, of Chicago, read his paper, "The Use of Reactance Coils in Generating Stations." An extended discussion took place, participated in by Messrs. A. S. Loizeaux, of Baltimore; Mr. W. L. R. Emmet, of Schenectady, and Dr. C. P. Steinmetz, of Schenectady. All agreed that the use of these coils is a valuable and necessary precaution in large stations, and in plants of very large capacity it is desirable to install oil switches in sections of the busbars to provide a degree of protection which the reactance coils themselves cannot furnish.

The paper "Some Unique Features of Power House Design and Operation" was read by title by the author, Mr. G. L. Knight, of Brooklyn. There was no discussion.

The paper "Efficiency of Motor Generators and Synchronous Converters" was read by the author, Mr. F. M. Farmer, of New York, and discussed by Messrs. W. L. Waters, of Pittsburgh; L. L. Elden, of Boston; P. Torchio, of New York; J. L. Burnham, of Schenectady, and Mr. C. W. Stone, of Schenectady. The consensus of opinion was that the split-pole rotary stands in need of considerable improvement, and that there is not as much difference between the value of the motor-generator and rotary converter in central-station service as would appear from efficiency tests upon individual machinery.

"Recent Improvements in Transformers" was the subject of a paper read by the author, Mr. W. A. Layman, of St. Louis, and discussed by Dr. C. P. Steinmetz, of Schenectady; Mr. W. G. Reed, of Pittsburgh, and Mr. W. S. Moody, of Schenectady. The value of silicon steel was commented upon and the desirability of permitting greater magnetizing currents was emphasized. In conclusion Mr. Layman protested against the incorporation of 5-minute to 30-minute insulation tests in modern specification writing.

The paper "Low-Pressure Steam Turbines" was read by the author, Mr. C. H. Smoot, of New York, and discussed by Mr. C. B. Burleigh, of Boston, and Mr. Dreyfus, of Pittsburgh.

The second technical session opened on Thursday afternoon with a report of the committee on protection from lightning. This committee consists of Messrs. B. E. Morrow, of Albany, N. Y.; H. B. Gear, N. J. Neall, O. A. Honnold and J. F. Vaughan. The subject was discussed at some length by Mr. D. B. Rushmore, of Schenectady, and by Mr. Percy Thomas.

The report of the committee on "Overhead Line Construction" was read by its chairman, Mr. Paul Spencer, of Philadelphia. A paper entitled "Recent Developments in Secondary Distribution Work," by W. K. Vanderpoel, of Newark, N. J., was also read. Mr. A. S. Ives, of Poughkeepsie, N. Y., followed with a paper on "Requirements and Specifications for Extra High Potential Transmission Lines." The three previous papers were then discussed together. The discussion was participated in by Messrs. Farley Osgood, of Newark, N. J.; Wilkinson, of Schenectady, and others. At the close of this discussion, on motion of Mr. G. H. Lukes, of Chicago, it was voted to instruct the incoming president to appoint a special committee on the preservation by treatment of poles and cross-arms.

The report of the committee on "Grounding of Secondaries" was read by its chairman, Mr. W. H. Blood, Jr., of Boston. This report defended the action taken at the committee's recommendation last year in passing a resolution in favor of requiring the grounding of secondaries where the potential between any wire and ground would not be over 150 volts and prohibiting grounding when such potential would be over 150 volts. This brought out a lively and extended discussion over the point of prohibiting grounding where the potential of any wire would be over 150 volts to ground. Remarks adverse to this prohibition were made by Messrs. P. Junkersfeld, of Chicago; Philip Torchio, of New York; C. P. Steinmetz, of Schenectady; M. O. Troy, of Schenectady; George H. Lukes, of Chicago, and J. R. Cravath, of Chicago. Mr. L. L. Elden, of Boston, a member of the committee, defended its report. In view of the very evident sentiment against the prohibition of grounding above the 150-volt limit, Mr. Dudley Farrand moved that the report of the committee be accepted as to the grounding of circuits under 150 volts, but that a prohibition of grounding above 150 volts be not concurred in by the association, but referred back to the committee for further consideration. A report of the discussion following the presentation of this report will be found on page 1472.

Messrs. Spencer, of Philadelphia, and Lukes, of Chicago, suggested that since water pipe grounds were admittedly the best, and since water-works authorities seemed inclined to oppose such ground connections, the N. E. L. A. take some official action and communicate it to water-works associations. In order to put such action on record, Dr. Steinmetz moved that it be the sense of the National Electric Light Association that by far the best method of grounding is by connection to water pipes; that grounding is necessary for the safeguarding of life, and that by the connection of ground wires to the water pipes for protection no harm can come to the pipes by electrolysis. This was unanimously carried.

Mr. W. L. Waters, of Pittsburgh, read his paper on "Performance, Specification and Ratings," calling special attention to errors in rating of machinery at 100 per cent power factor. This was discussed by Messrs. Torchio, of New York; S. D. Strong, of New York, and H. L. Wills, of Savannah, Ga.

"Central Stations in Towns of Less than Four Thousand People" was the title of a paper read by Mr. J. S. Knowlson, of Schenectady, which took up in an interesting way some of the small central station problems seldom treated before the N. E. L. A. This was discussed by Messrs. E. D. Dreyfus, of Pittsburgh, and L. L. Elden, of Boston. This concluded the technical sessions.

COMMERCIAL SESSIONS.

The commercial program was opened in a parallel session on Thursday morning, with Mr. W. W. Freeman, of Brooklyn, as chairman. The first paper was one by Mr. W. H. Atkins, of Boston, entitled "Methods of Introducing Tungsten Lamps and Their Effffect on Central-Station Income." This was a compilation of information from various central stations on this subject and was read in abstract only. Discussion on this paper was participated in by Messrs. M. S. Seelman, of Brooklyn; J. T. Hutchings, of Rochester, N. Y.; Douglas Burnett, of Baltimore; J. F. Davidson, of Montpelier, Vt.; H. W. Hillman, of Grand Rapids, Mich.; Joseph D. Israel, of Philadelphia, and R. M. Searle, of Rochester, N. Y.

"Practical Illuminating Engineering in Connection with a Commercial Department" was the subject of a paper by Mr. G. A. Sawin, of Newark, N. J. Messrs. J. D. Israel, of Philadelphia; F. E. Smith, of Boston, and C. N. Stannard, of Denver, discussed the paper.

Mr. John C. Parker, of Rochester, N. Y., gave a paper on "Intensive Methods of Business Development," which told how a force of specialists had been brought together for the engineering problems of the commercial department, each man being a specialist in some line. These methods were discussed and indorsed by Messrs. E. W. Lloyd, of Chicago; Graves, of Brooklyn, N. Y.; H. W. Hillman, of Grand Rapids, Mich.; Mr. Jones, of New York, and Mr. Stevens, of Brooklyn. Mr. George N. Tidd, of Philadelphia, and Mr. R. M. Searle, of Rochester, N. Y., also made contributions to the discussion.

The next paper was on the subject, "Can a Display Room Be Conducted on a Profitable Basis?" As Mr. Frank B. Rae, Jr., the author of this paper, was unable to read it because he was hoarse from cheering at the ball game the day before, it was abstracted by Mr. J. F. Becker, of Brooklyn.

Mr. C. N. Stannard, of Denver, presented a paper on "Advantages to Be Derived from Uniform Commercial Department Forms and Methods." This closed the first commercial session.

The second commercial session (Thursday afternoon) was

called to order by Vice-Chairman Percy Ingalls, Chairman Freeman coming in soon afterward.

The first paper, "Electricity for Domestic Purposes," by Mr. M. E. Turner, of Cleveland, was read by the author, and discussed briefly by Mr. H. W. Hillman, of Schenectady.

Three papers, "Compilation of Load Factors," by Mr. E. W. Lloyd, of Chicago; "Electric Power," by Mr. H. J. Gille, of Minneapolis, and "The Advantage of Group or Individual Drive," by Mr. C. A. Graves, Brooklyn, were discussed simultaneously. Mr. Gille said that the committee has in its possession about 100 typical load curves of different industries. Mr. H. W. Peck, of Rochester, N. Y.; Mr. E. W. Penrose, of Tyrone, Pa.; Mr. H. C. Alvord, of Long Island City; Mr. E. F. McCabe, of Lewistown, Pa., and Mr. Samuel Insull, of Chicago, together with Mr. Harold Almert, of Chicago, and Mr. Myers, of Philadelphia, discussed the paper. The importance of obtaining as high a low factor as possible, was recognized by all the speakers, as was the necessity of settling upon a standard definition of the term. Mr. Insull gave a valuable discussion of the manner in which the load factor of a small central station may be improved by securing electric pumping and interurban railway business.

Mr. Arthur Williams, of the New York Edison Company, then read his paper, the "New York High-Pressure Water System," and pointed out the value of an electrically driven fire pumping service to both the community and the central station.

A timely paper was that on "Relation of Electric Vehicles to Central Station Business," read by the author, Mr. James T. Hutchings, of Rochester, N. Y., who introduced his remarks by thanking the technical press for the light which it has thrown upon this subject on behalf of the central-station man. A prolonged and enthusiastic discussion of this subject then took place, in which it was generally recognized that a great future awaits the advent of the electric vehicle in general commercial and pleasure service. Vehicles are much improved to-day as compared with the equipment of a few years ago. The economies over the cost of horse traction are indisputable, and can be shown by figures drawn from hundreds of cases in practice. It is desirable to reduce the rates for electric-vehicle charging to as low a point as possible. There is still room for the education of vehicle users in the proper care of this class of equipment, and its maintenance cannot safely be neglected. The central station itself should specialize this class of work by employing one or more solicitors practically all the time in this field. The paper was discussed by Messrs. Day Baker, of the General Vehicle Company, Boston; Frank J. Stone, of the Electric Storage Battery Company, Boston; Newman, of the Woods Motor Vehicle Company; C. D. Hibler, of Rochester, N. Y.; Rice, of Indianapolis; W. P. Kennedy and J. H. Vail, of the Studebaker Company, New York; F. M. Tait, of Dayton, Ohio, and T. Commerford Martin, editor of *Electrical World*.

At the Friday morning commercial session the first feature was the reading in abstract of a paper on "The Adoption of Electric Heat for Industrial Purposes," of which Mr. Charles J. Russell, of Philadelphia, was editor. This paper contained information compiled from a number of companies on this subject.

A paper on "Electricity for National Advertising," by Mr. George Williams, of New York, was presented in abstract, the author not being present. This was discussed by Messrs. T. I. Jones, of New York; H. J. Gille, of Minneapolis; W. H. Gardner, of New York; C. N. Stannard, of Denver, and Frank M. Tait, of Dayton.

"The Development of Revenue from Existing Customers" was the subject of a paper by Mr. Theo. I. Jones, of New York, which was discussed by Messrs. H. J. Gille, of Minneapolis; Jos. F. Becker, of Brooklyn, and C. N. Stannard, of Denver.

The chairman announced at this point that the convention would listen to an address on a general commercial subject, such having been a custom established last year as a part of the commercial program. This address was given by Hon. Frank Bergen, of New Jersey, and was full of philosophical meat on the general subject of the pursuit of riches and its relation to the general public. The convention then went into executive session to transact its concluding executive business.

ELECTION OF OFFICERS.

On the report of the nominating committee the following officers were elected:

President—Mr. Frank W. Frueauff, Denver, Col.

First Vice-President—Mr. W. W. Freeman, Brooklyn, N. Y.

Second Vice-President—Mr. John F. Gilchrist, Chicago, Ill.

Secretary and Treasurer—Mr. Frank M. Tait, Dayton, O.

Members of the executive committee, to serve until July 1, 1912—Mr. Charles A. Stone, Boston; Mr. Dudley Farrand, Newark, N. J.; Mr. H. M. Byllesby, Chicago, Ill.

President-elect Frueauff was escorted to the chair, and made a few remarks to the effect that the active policy of the present administration in extending the usefulness of the association would be continued.

The new president of the National Electric Light Association, Mr. Frank W. Frueauff, was born at Columbia, Pa., on March 24, 1874. Seven years later his parents removed to Leadville, Col., and he received his education and early training in the

PRESIDENT F. W. FRUEAUFF.

western state. In 1891 he began his engineering career by entering the service of the Denver Consolidated Electric Company as meter reader and lamp clerk. His advancement was rapid, and in 1899 he was elected secretary of the Denver Gas & Electric Company on the organization of that powerful and progressive corporation. In 1904 he become its vice-president and general manager, and to him must be attributed much of its success. "Busy Frank" is a local epithet that fits the case very well.

This brief sketch of his commercial and professional relations by no means completes the record up to date, for he is also vice-president of the Pueblo (Col.) Gas & Fuel Company, the Lincoln (Neb.) Gas & Electric Light Company; the Lebanon (Pa.) Gas & Fuel Company and the Doherty Operating Company. He is also treasurer of the Summit County (Col.) Power Company, secretary of the Lacombe Electric Company, and partner in the financial and engineering firm of Henry L. Doherty & Company, as well as a director of the Massillon (Ohio) Electric & Gas Company.

In connection with all these interests in the electric and gas fields, Mr. Frueauff has taken an active and public-spirited part in the work of the national bodies representing them. He did much to make a success of the notable Denver convention of the National Electric Light Association, of which he has lately been serving as first vice-president. He is a past-president of the National Commercial Gas Association, and is also a member of the American Gas Institute and the Colorado Light, Power & Railway Association. His social leanings are indicated by his membership in the Lawyers' Club of New York, the Denver Club, the Denver Athletic Club, the Denver Country Club and the Overland Country Club of Denver, the Sons of Jove and El Jebel Shrine.

OTHER EXECUTIVE BUSINESS.

Mr. Dudley Farrand introduced a resolution, which was unanimously carried, thanking Mr. W. D. Weaver, editor of the *Electrical World*, for the library contributed to the association. President Eglin expressed the hope that this gift of Mr. Weaver would be an incentive to others to contribute literature of a permanent value to the association.

Mr. Arthur Williams introduced a resolution thanking the various committees which made the convention such a success.

Mr. Henry L. Doherty, as chairman of the committee on the president's address, presented his report, and commented on the fact that the total membership of the association had been doubled during the administration of President Eglin, and said that the recommendations in the president's address, if carried out, will enable the association to accomplish the following desirable things: (A) Reach every part of the country and every company by means of State and geographical sections. (B) Reach every branch of the business, such as accounting, commercial, engineering, etc., by means of the national special sections. (C) Reach every man by means of the company sections. (D) Supply every need for the interchange of information by means of national conferences on special subjects.

Mr. H. M. Edwards, as chairman of the committee on uniform accounting, reported that the report of his committee, which had been made at the first general session of the convention, had been thoroughly discussed in the accounting sessions and approved, and he asked that the association formally adopt the recommendations in the report as to the classification of construction and equipment accounts. After some discussion it was voted to refer this report to the executive committee with power to adopt it, as it was not felt that the convention could intelligently vote on this report on account of the limited time given for its consideration.

Mr. T. C. Martin introduced a resolution, which was adopted, thanking the officers of the association for their conduct of the business of the association, which has brought about the wonderful growth of the past year. Mr. Frank W. Frueauff, chairman of the general convention committee, moved a vote of thanks to the local members of the convention committee, who, as he put it, "did the real work" of preparing for the convention. The executive session was then adjourned.

ACCOUNTING SESSIONS.

The first of the accounting sessions was called to order by Mr. Frank W. Frueauff, Denver, on Thursday morning, who called Mr. H. M. Edwards, New York, to the chair. The report of the committee on uniform accounting, which had been presented at the general session on Tuesday and referred to the accounting session, was again presented in abstract by Mr. Edwards. This report was discussed by a number of the delegates, and adopted. The action of the accounting session regarding the report of this committee was reported to the general session on Friday, as noted above. The report was referred to the executive committee with power to act.

Before presenting the report of the committee for discussion Mr. Edwards said that there had been an accounting committee for three years, and its work had developed that the most unusual and surprising differences in methods existed among the various member companies. It must be evident that all of these methods could not be right, and the committee wanted to see that the best were selected. In most companies it had been found that much of the accounting work was done outside of the accounting department. That was not economical. The accounting departments were equipped to do this work and should be in a position to furnish information whenever it was needed.

Mr. E. J. Allegaert, Newark, N. J., read his paper on "Branch Office Accounting." Mr. L. M. Wallace, Boston, then presented his paper on "Customers' Accounts, Including the Handling of Meters in Their Financial Aspect." The papers of Mr. Allegaert and Mr. Wallace were discussed together. At the conclusion of this discussion an adjournment was taken until afternoon.

When the session convened on Thursday afternoon Mr. W. E. Freeman, New York, read his paper on "Pay-roll Problems in the Electric Light Industry." It was followed by discussion. Mr. J. L. Baily, Baltimore, then read his paper on the "Care and Handling of Supplies," and it was followed by considerable discussion of various points of practice. Mr. H. R. Kern, Philadelphia, read a paper on "Cost Accounting." The discussion on this paper included accounts of working-order systems. Mr. George W. Claflin, Boston, presented his paper on "Depreciation Accounting for Small Companies." This valuable contribution brought out accounts of other experiences with the important subject of depreciation. Adjournment was then taken in the accounting section.

MEETING OF ASSOCIATE MEMBERS.

At noon on Wednesday, a meeting was held of the exhibitors in one of the smaller convention halls, when no fewer than 41 companies were represented by one or more officials. Mr. F. H. Gale presided as chairman of the exhibition committee. A very cheerful spirit pervaded the meeting on account of the great success of the show and the excellent financial condition. Mr. Gale spoke of the hearty co-operation of the association, and pointed to the success of the plan of combining the opening of the exhibit with the "reception" under one roof, as the first night function, as contrasted with the plan of the Street Railway Association of separating these affairs. The improvement resulting was notable. Mr. Gale stated that the committee had held six meetings, and he called attention to the work done and the various responsibilities assumed in providing also for the meeting halls of the association, secretarial office, etc. Much credit was due to Mr. Paul M. Bauder for his taste and skill in the illuminations. The report of Treasurer H. M. Post showed a balance of about $1,500 this year, added to $900 from last year. The space sold amounted to $8,380. Secretary W. Neumuller showed an increase from 41 to 68 in the number of exhibitors, 83 booths as compared with 55, and 10,800 sq. ft. provided as compared with 10,800. Outside the regular committee meetings, the chairman and secretary held several meetings in New York and Atlantic City. A nominating committee was then appointed of Mr. J. M. Wakeman as chairman, and Messrs. Ayer and Hunting, and on its report Messrs. Gale and Doane were elected to succeed themselves. Mr. H. W. Young was made a member of the committee, and Mr. H. G. McConnaughy was elected to fill the place of Mr. B. Wall for an unexpired term of two years. The exhibition committee as a whole then went into executive session and reëlected Chairman Gale, Treasurer Post and Secretary Neumuller for their respective positions. It was decided for general benefit and convenience to keep the exhibit open until 10:30 p. m., Friday, although the sessions closed in the afternoon.

CONCLUDING SESSION OF THE CONVENTION.

Much interest in the problems of isolated plant competition and steam heating marked the final session of the convention on Friday afternoon, which was also the end of the commercial program. The paper of Mr. T. I. Jones, New York, on "The Development of Revenue from Existing Customers," was first discussed. Those taking part in the discussion were Messrs. M. C. Osborne, Spokane, Wash.; Joseph A. Sutton, Baltimore; E. F. McCabe, Lewistown, Pa., and Douglas Burnett, Baltimore, Md. The discussion centered about the placing of flatirons on a free trial, a point of value being the introduction of flatirons to the housewife by the meter reader at the psychological moment, which is when the monthly reading is being made.

President Eglin took occasion to praise the quality and manner of preparation of the commercial papers, and expressed his personal thanks to Mr. Percy Ingalls, vice-chairman of the commercial session. Mr. Ingalls then took the chair.

Mr. R. S. Orr, Pittsburgh, then read his paper on isolated plants, which was discussed by a number of members, including Messrs. Joseph McKinley, Pittsburgh; H. W. Peck, Rochester, N. Y.; T. I. Jones, New York; E. W. Lloyd, Chicago; Paul Mueller, Erie, and M. F. McAlpin, New York. The discussion was largely devoted to the difficulties of competing with engines

in isolated plants driven by illuminating and natural gas. It was the general opinion that natural gas is a most formidable competitor of the central station dependent upon coal. With a rate of 4 cents downward, however, there is a good prospect of competing with illuminating-gas engines. The central station has in the tantalum and tungsten lamp a valuable weapon with which to produce economies in existing isolated-plant installations.

The next paper, "Central Station Operation of Steam Plants," was read by the author, Mr. S. M. Bushnell, Chicago. It was discussed by Messrs. Paul Mueller, Erie, Pa.; H. A. Denman, Detroit; Arthur Williams, New York; J. C. Brooks, Philadelphia, and J. F. Gilchrist, Chicago. This appears to be a growing branch of central-station service, and cannot be neglected where large business is sought.

The last paper of the session was read by Mr. A. L. Eustice, Pittsburgh, on "The Effect of Various Conditions of Maintenance on the Efficiency of Illumination." It was briefly discussed by Mr. E. L. Elliott, New York.

A pleasant feature of the session was the decoration of President-elect Frueauff with the badge of his new office by the retiring president, Mr. Eglin, who congratulated the new president on the character of the organization of which he is now the head. The convention was finally adjourned at 4:40 p. m. on Friday.

Convention Notes.

President Eglin manifested praiseworthy promptness in opening and closing sessions, and everything was run on schedule time.

During the evening session of Tuesday all the lights went out suddenly, and President Eglin created some amusement by saying: "Gentlemen, this is a private plant."

Among former presidents in attendance were Messrs. James I. Ayer, Samuel Insull, H. L. Doherty, E. A. Armstrong, Dudley Farrand, W. H. Blood, Jr., C. L. Edgar and Charles R. Huntley.

On Thursday evening 22 gentlemen connected with the Stone & Webster companies met at an informal dinner at the Hotel Chalfonte. Mr. W. H. Blood, Jr., representing the organization, was the host.

On Tuesday evening there was a slight fire in the St. Charles Hotel, where many convention people were guests. There was some excitement, but the fire was quickly extinguished, and no one was injured.

One of the pleasing features of the entertainment provided by the convention committee was ocean sailing. Informal parties were made up as time permitted, and roomy sail-boats were always at their disposal at the Inlet.

In front of the meeting hall, on the Million Dollar Pier, is a pool where a number of seals disport themselves, and the barking of these animals could be heard occasionally above the voices of the gentlemen engaged in the convention discussions.

Miss Edith M. Myers, of New York, was in charge of the registration bureau, as usual. She said that her duties were more onerous than at previous conventions, owing to the steady stream of visitors, there being no cessation on Wednesday, as in previous years.

Mr. Farley Osgood, of Newark, N. J., general superintendent of the Public Service Corporation, is authority for the statement that his company was represented by no less than 200 men sent to the Atlantic City convention. Of these 40 came from Mr. Osgood's individual department.

There was considerable speculation as to the location of the next convention. Rochester, Detroit and Denver were mentioned, the city first named being especially active in its efforts. The matter will be decided by the executive committee, following the usual convention. It would not be surprising if a Western city were chosen.

Mr. Dudley Farrand, of Newark, N. J., former president of the association, in his report as official representative on the national conservation commission, recommended that member companies practice the closest possible economies in routine operation. He said that there is more to be gained by economical use of natural resources than there is in effort to replace what has been wasted.

Thursday evening's entertainment feature was a "Café Chantant" in Marine Hall, Million-Dollar Pier. The interior of the auditorium was attractively decorated, the flags of all nations being conspicuous. Small tables were scattered about the floor, and refreshments were served. A large portion of the audience found room in the gallery. A vaudeville performance of several numbers was given. The music, by an orchestra under the direction of Henry Conrad, was good.

The Rochester (N. Y.) Railway & Light Company was represented by as many as 22 of its officers and staff, six of whom were accompanied by ladies, but the curious fact was that they did not all come as one party. Vice-President Searle explained that as accidents were still possible on railways, and as it was not desired to have the whole executive swept away at one blow, it was deemed better to divide the representation up into several traveling units, going and coming. The trip in a private car would be very agreeable, but "was not good business."

One innovation at the sessions of the convention was the distribution of "discussion notices." These were printed cards announcing that each speaker on rising was expected to announce his name and home city to the chair. Every person entering the hall was given one of these cards. On the back was a space for the name, company, city, Atlantic City address, and paper discussed. These blanks were to be filled in by any person taking part in a discussion, so that if the stenographer heard the name indistinctly a written record would be available for him.

Mr. George F. Porter is to be congratulated on the general success of his work as master of transportation, all the special trains and other arrangements being well run and well patronized. It is an arduous task, but not one could undertake it with more pleasure or enthusiasm. As former secretary of the association, Mr. Porter made a fine record, and he now remains one of its most loyal and devoted servants, giving time and thought freely for its welfare. There was only one element of sadness in the whole affair, and that was the absence of Mr. C. O. Baker, Jr., who under the Porter régime was the transportation manager, and who, it was reported, lay dangerously ill at his home in Newark.

On Thursday luncheon was given to the technical press, represented by Messrs. C. W. Priee, J. M. Wakeman and T. C. Martin, in recognition of the work done to promote the welfare of the association. A long table was laid in one of the dining-rooms, and decorated with flowers, and in addition to the guests the following participated: Messrs. W. C. L. Eglin, S. Insull, C. L. Edgar, C. R. Huntley, W. H. Blood, D. Farrand, H. L. Doherty, F. W. Frueauff, E. A. Armstrong, N. F. Brady, T. E. Murray, A. Williams, J. F. Gilchrist, W. W. Freeman, F. W. Smith, T. N. McCarter, E. W. Rice, Jr., J. R. Lovejoy, R. A. Carter, W. J. Sefton, H. M. Edwards and A. J. De Camp. A couple of hours were spent very agreeably. Mr. Williams proposed the health of the guests, and Mr. Martin replied.

Several of the larger companies availed themselves of the convention to get their men together in separate conference, and the most notable example was that of the holding concern, the Susquehanna Light & Power Company, which held a special convention of its own on Friday afternoon and Saturday. A regular program was provided of papers and discussions, with a "Question Box." Some 30 men were present, including President George Bullock, Assistant to the President E. E. Witherby,

Secretary and Treasurer A. S. Cooke, the president's secretary, H. Morgan, Engineer G. K. Dustin, Manager Commercial Department A. V. Wainright, Manager Industrial Department H. L. Sterrett, and Advertising Expert F. E. Schornstein. The others were leading officials of the companies operated.

Mr. W. H. Harding, who was secretary of the association at a very early stage of its life, was at Atlantic City during the week and was literally stunned by the marvelous growth to 3200 members. He remembered the time when with great effort and pride he managed to lift it from 30 to about 125 members. He found but few of the veterans left, and was struck with the large proportion of young men. He was much impressed with the magnitude and efficiency of the work done at the convention by Miss Billings, as assistant secretary, and her staff.

The past presidents of the association are becoming numerous, and it is a good sign of healthy, sustained interest that so many are present. This year they numbered nine, including Messrs. Huntley, Insull, Armstrong, Blood, Edgar, Williams, Ayer, Farrand and Doherty. All took an active part in the proceedings, and this year a special badge was furnished for them, not superseding the time-honored gold button, but providing a gold name-strap and disk to which the much-coveted mark of distinction could be attached. To some of these were appended various ribbons indicative of special committee work. The convention had, by the way, 14 different colors for its badges, and few, if anybody, had memorized the list. Probably the new president, Mr. Frueauff, has the most. His ribbon bunch was a complete spectrum.

The presence of President Frank A. Vanderlip, of the National City Bank, and his forcible address were a notable event in the history of the association, while it was equally unusual that men like Mr. C. A. Coffin and Mr. A. N. Brady should be in attendance. The welcome accorded to Mr. Coffin at the meeting on Wednesday night will not soon be forgotten by anyone who saw and heard it. To greet these three gentlemen and Mr. George S. Graham before the meeting, President Eglin invited to dinner in the Forest Room of the Marlborough-Blenheim the following officers of the association, or operating managers of prominence connected with member companies: Messrs. S. Insull, C. R. Huntley, C. L. Edgar, H. L. Doherty, Dudley Farrand, N. F. Brady, T. N. McCarter, J. B. McCall, L. B. Gawtry, G. Urban, Jr., and E. W. Burdett. The occasion was not one for speech-making, and the dinner was both brief and served with swiftness, but it afforded a delightful opportunity for social intercourse among the leaders. It was Mr. Vanderlip's first visit to an N. E. L. A. convention, and Mr. Coffin was ready to confess that his average of attendance was not much higher.

The opening reception on Monday night found the exhibits, of which this year there were no fewer than 68 in 83 booths, in a remarkable condition of readiness. The arrangement of the exhibits in a large hollow square around three sides of the space on the pier added greatly to the effect, while giving a clear view of all at once. The central space made a most comfortable and luxurious lounge by day, and was available for dancing at night. The pier is brilliantly illuminated, with a ceiling and sides studded with incandescent lamps, supplemented in this instance by hundreds more around the booths, intermingling with the shrubbery and flowers. The excellent music of the Filipino band was once in a while a little too much for oratorical effort in an adjacent meeting room; but many preferred the band. At the entrance to the pier were the usual effective arrangements for registration, association headquarters, etc. The fine weather that prevailed almost the entire week rendered overcoats and umbrellas a superfluity, and it was not until breaking-up time on Friday that the rain became disagreeable. The only out-door event, that of the baseball game on Wednesday afternoon, fitted snugly between two very heavy showers on Tuesday and Wednesday nights. Altogether it was a comfortable week for work and recreation and the display of toilettes.

Accounting System of the New York Public Service Commissions.

The New York electric companies have rearranged their systems of accounting as of Jan. 1, 1909, to conform to the requirements of the classifications adopted by the two Public Service Commissions, and the following account of the new system is of particular interest as reflecting a central-station view of its merits.

While the rearrangement of accounting involved by the adoption of the system did not mean radical changes for all the companies, it did require considerable preliminary preparation, and also, in some important particulars, will prevent the possibility of comparisons with previous years. The schemes of accounting previously existing, however, had been in force for periods of years, varying with the practice of each company; and, as during these periods many changes had occurred in the production and distribution processes, it is undoubtedly true that the necessities of the individual companies would have required some changes in their accounting methods. On the other hand, no company would lightly disorganize its system of comparisons. Electric lighting statistics have principally a relative value and the various companies, if left to themselves, might have preserved some of their comparisons; but on the other hand, by adopting the Public Service Commissions' scheme the companies will profit by the ability to compare their statistics with their contemporaries. As a general proposition, therefore, the sum of the advantage may be conceded to be in favor of the adoption of the commissions' scheme of accounting and the discussion may proceed to the study of the details of that scheme as applied to the affairs of a company.

CAPITAL ACCOUNTS.

The sub-accounts provided by the commissions cover the capital expenditures occurring after the introduction of the system on Jan. 1, 1909. The capital accounts at Dec. 31, 1908, are to be combined in one account called "Fixed Capital, Dec. 31, 1908." It is idle to speculate now as to what action will ultimately be taken in the disposition of this account or what significance attaches to its creation. It is sufficient to know that it certainly facilitates the introduction of the new system, as it would be a huge task to analyze the existing accounts according to the new classification and would undoubtedly cause great delay and confusion.

The commissions recognize as proper subjects for capitalization the expenditures during construction of the following nature:

Engineering and superintendence.
Law expenses.
Injuries.
Taxes.
Interest.
Miscellaneous, including thereunder salaries and expenses of executive and general officers, or a suitable proportion thereof, clerks engaged on construction accounts, insurance and all expenditures of a special or incidental nature which cannot properly be provided for elsewhere.

These provisions of the commissions' scheme are broad and comprehensive, the intent being to capitalize the actual cost rather than that amount only which might at first glance appear in a survey of the item itself.

The scope of the capital account for meters, converters, arc lamps, etc., as defined in the classification, has, by recent action of the commissions, been extended. As originally outlined, such accounts included the cost of the devices actually in service, those in reserve to be carried in "supplies." Some companies do not capitalize the cost of setting meters and converters or connecting arc lamps in customers' premises, although the commissions allow the practice. It is desired, therefore, to charge these devices to capital account when purchased, providing suitable property records to show the location of each unit, whether in customers' premises or in store. This plan would permit meters to move freely between the storeroom and

customers' premises without requiring a financial entry in the books for each operation. The commissions were therefore requested to modify the rules covering these devices as originally promulgated, and this they have now done, stipulating, however, that in the annual report the companies shall show the number of units in service, the number in store and the number in process of repair.

The rule of the commissions that capital expenditures, in addition to being charged to the respective sub-accounts as provided, shall be further divided into original capital, additions, betterments and renewals and replacements, adds very substantially to the work of the accountants. About 34 accounts for tangible property are prescribed by the commissions, and, as each entry must show whether the property acquired is in the nature of an addition, a betterment or a renewal, the 34 accounts are multiplied by three, making 102. These requirements are purely of commission origin and purpose. They are in the nature of an ultra refinement and are one of the causes of the feeling of dismay and difficulty which some of the smaller companies in the State have experienced in endeavoring to adapt their accounting system to the commissions' scheme. The requirement seems to be peculiar to the New York State Commissions' scheme only, as it does not appear in the classification or text of the Wisconsin commission's system. In this connection also must be considered paragraph 16 of the classification, "First entries must enable identification," and paragraph 21, "Particulars required to be shown in entries."

FLOATING CAPITAL AND LIABILITIES.

The sub-accounts provided hereunder varied from those formerly in use by many companies and occasioned changes in methods. One important provision is the requirement that "investments" should be divided as to whether bound or free, by "bound investments" being meant those which have been deposited as collateral and by "free investments" those securities which might be readily translated into cash. The account "unamortized debt, discount and expense" is provided to include the discount on bonds and the expense of their issue, and the requirement is made that these accounts may not be capitalized but are to be amortized over the life of the security to maturity. In this respect the commisssions have departed from the usual practice, as the cost of procuring money has generally been regarded as a proper subject for "capitalization." It is so regarded by the Massachusetts Gas Commission and also by the Wisconsin commission. In Wisconsin, as a matter of fact, permission to capitalize discount and expense of bond issues is legalized by the law of the State, which permits such discount up to 25 per cent to be so capitalized. Public service utilities located in the State of New York will, to this extent, be at a disadvantage with their contemporaries in other States.

In general, it may be stated that the commissions' requirements as to floating capital and liabilities are clearly defined and so arranged that the balance sheet of any company will show its exact condition at the time when the balance is struck.

INCOME ACCOUNT.

This is identified in the commissions' classification as Schedule B, and includes the gross earnings from the sale of electric current and miscellaneous revenues, also the operating and non-operating expenses. The distinctions between operating and non-operating income accounts are clearly defined.

The expenses are divided into "operating expenses" and "expenses of outside operations," the latter caption including taxes and uncollectible bills. The commissions gave as a reason for making this separation that theoretically taxes and uncollectible bills hardly came under the designation of operating expenses, for the reason that they were not under the control of the operating company. On the other hand, it was recognized that such expenditures constituted part of the total cost of the electric current sold, and many companies have, therefore, never been convinced that this technicality was sufficient justification for making the separation. The companies would have preferred to classify uncollectible bills as a sub-account under "collection expense" and taxes as one of the division of "general and miscellaneous expense."

Many companies had been in the habit also of charging interest on consumers' deposits as part of the expense of collection, but the commissions require that this be charged to the account "interest accrued on other unfunded debt," one of the sub-accounts under "income deductions." This is open to question. It does not follow that because the item consists of interest it should be charged to interest account. Some consideration should be given to the circumstances under which the interest accrues. Companies do not borrow money from customers to conduct their operations. The law under which they are incorporated requires that they shall supply their product to every applicant located within 100 ft. of their mains. In other words, the companies are constituted by law "common carriers." This being the law, it was necessary to protect the companies, otherwise any individual, no matter what his business or what his previous financial history, could compel a company to extend to him credit. Therefore, the law provided that all consumers should pay to the companies a deposit approximating two months' bills, and the companies were required to pay interest on the amount of the said deposit at the rate of 6 per cent. The deposit being intended as a protection for the accounts receivable, and furthermore, as uncollectible bills were agreed to be a proper charge to the cost of supply, it would seem that the cost of this insurance of the debts, in this case the interest on the deposit, should be considered as part of the collection expense. This general principle appears to be recognized in the classification of fixed capital accounts, where interest on moneys borrowed for construction purposes is recognized as a proper charge to construction or to fixed capital account. Of the same general nature is the commissions' requirements in regard to discounts for prompt payment. The classification requires that charges to fixed capital and income accounts shall be cash costs and not costs based on credit. If a company keeps its money in a bank, the interest which the bank allows upon its balances becomes a credit to "interest revenues," but if because it gets better return from discounting its bills it withdraws the money from the bank for this purpose, the discount is not to be credited to interest revenues, but the net cash expenditure is to be charged to the account for which cash was expended.

The commissions' classification requires that the cost of the overhead pole lines and the underground conduits shall be divided as between transmission and distribution, unless the expenditure can be identified as belonging solely to one of these general divisions. If a company has a conduit system and has in the ducts a transmission cable and a distribution cable and is required to repair the manhole cover or pump gas or water out of the manhole, it is very difficult to apportion this expense as between transmission and distribution, nor is there any useful result achieved when this has been done. A better plan would be to treat the pole line and the underground conduit system as a unit, confining the transmission and distribution expenses to the conductors as attached thereto or drawn therein.

The commissions' rules in regard to amortization have probably attracted more attention than the remaining part of the classification as a whole. When the classification was in the tentative stage and hearings with the companies' representatives were occurring, the latter recommended that while amortization or depreciation accounts should be provided in the classification, the amount to be reserved and the method of arriving at that amount should be left to the discretion of the individual companies. This the commissions have done, except that the amount reserved during the month shall be lessened by the amounts charged that month to the various repair accounts. By this means, however, a double estimate is introduced which would not have been necessary had the original idea been followed of leaving the amount of the amortization and the method of its determination to the individual company. The classification furthermore required that the rules adopted by a company and a sworn statement of the facts and expert opinions

and estimates upon which they are based should be filed with the commissions on or before Jan. 1, 1909.

One of the difficulties which companies are meeting is the requirement that charges against the reserve shall be identified with the original expenditure for the property replaced. The replacement itself is charged to "fixed capital account-replacements" and the commissions will naturally look for a corresponding credit to one of the other sub-classifications under fixed capital. If the thing replaced was installed years previously, as is frequently the case, and especially if the thing replaced was part of a continuous structure and was not an individual piece of apparatus, it is difficult to make the identification both as to the thing itself and its original cost. The classification, however, provides that in such instances the charge to the reserve may be based upon estimates. If, however, a company had not maintained a reserve account prior to Jan. 1, 1909, the original cost of the property replaced would have to be charged against its surplus account, it being intended in such an event that the amount reserved after Jan. 1, 1909, should apply to the depreciation accruing after that date only.

The Patent System in Its Relation to Industrial Development.

An abstract was given in these columns May 20 of a paper presented by Mr. Frederick P. Fish at the annual meeting last week of the American Institute of Electrical Engineers entitled "The Patent System in Its Relation to Industrial Development," and an abstract of the following discussion on the paper is given below.

Prof. F. B. Crocker, of Columbia University, said that the broad and clear statement of patent rights contained in the paper would do much toward putting the matter in its true light in the minds of electrical engineers, who are particularly affected by patents because of the novelty and rapid progress of their profession. He suggested that the board of directors of the American Institute of Electrical Engineers should appoint a committee to investigate and report upon what reforms in our patent system are desirable, and how they may be best brought about. On this committee there should be representatives, respectively, of the patent bar, manufacturers, operating companies and of engineers who do not act as patent experts, as well as of those who do. This same committee should also consider and report upon the establishment of a single United States Appellate Court in patent cases, as well as on reforms in the Patent Office, especially in securing prompt and competent examination of applications, simplification of interference and appeal proceedings, etc. Professor Crocker said that he considered the great bulk and complication of expert testimony as the worst of all the present evils. If two experts were appointed by the court from among specialists of experience and standing, the facts could be brought out in less than one-quarter of the time and space now required to mix them up. Most of the points should be settled with little or no controversy, and in case the two experts failed to agree on a certain matter, a third could be called in. Even if his decision were wrong, the case would be so boiled down that the court and counsel could see the precise issue. The need of this reform is particularly pressing for electrical companies, because the judges and lawyers have the greatest difficulty in understanding them, and the American Institute of Electrical Engineers is therefore the body most interested in and qualified to lead in bringing about the reforms proposed.

Mr. A. G. Davis, of the patent department of the General Electric Company, said that there has been noticeable, during the last two or three years particularly, a tendency on the part of a certain class of inventors or persons interested in inventions to criticize our present patent system and that there seems to be an impression that the patent situation is being handled by the patent lawyers, and that this is all wrong. The patent lawyers of the country, he said, are a unit in their desire to simplify the patent procedure wherever such simplification can be effected without risk to the litigant, and are a unit in their desire to see that a meritorious inventor receives adequate protection and adequate reward. The complexity of our present procedure, and the delay and expense attendant on any thoroughly tested patent litigation, are therefore not the fault of the patent bar, nor are they the fault of the judges, nor, broadly speaking, are they the fault of the system. The real trouble is that the questions necessarily arising in an ordinary patent suit are exceedingly complex, so that a patent litigation is necessarily one of the most difficult, and therefore one of the most expensive, sources of litigation in which a man can engage. While the patent system is, like any other product of the human mind, capable of improvement, and will be improved, this improvement will not be produced by any one radical change at one time, but rather by the slow growth by which all real legal reforms are attended. In conclusion Mr. Davis ascribed the discontent as due to patentees or patent owners who have failed to enforce rights because, as a matter of fact, they did not have any rights to enforce.

Mr. Arthur Von Briesen submitted a memorial being circulated by the Merchants' Association of the City of New York which advocates that measures be taken toward bringing about at the earliest possible date an international patents conference with a view to bringing the laws of all civilized nations into conformity with the principle that no restrictions shall be placed in the path of meritorious inventors who desire to have their inventions duly protected in any country.

Mr. Livingston Gifford said he thought that the sentiment of the bar is absolutely unanimous in favor of the patent law as it stands to-day, but that the system of administration, the taking of testimony and the hearing and deciding of cases are nevertheless, he believes, all wrong. He opposed the appointment of the committee suggested by Professor Crocker to revise a system which has existed for a half century unless it should base its work on definite propositions presented to it for action. He believed the practical course was, as suggested by Mr. Fish, the constitution of a court that will hear all patent cases as a court of last resort, and that as this court became acquainted with all the difficulties that arise in the different parts of the country, it might in time work out a solution of the problem and correct present evils.

Mr. E. W. Rice, Jr., vice-president of the General Electric Company, said that while he believes that an appellate court, such as Mr. Fish suggested, should have one member of first-class technical engineering training, nevertheless, his experience with lawyers has shown them to possess such a wonderful capacity for grasping abstruse problems in science and engineering and for restating them in such a clear and simple manner as to confuse a so-called expert, even without a technical expert sitting as a member of the court, the patent system would remain fairly safe. He believed that inventors, as a class, received their full share of reward as compared with men in other departments of life. The manager of a great works, or executive of a great business, must use the same originality and same skill in managing the business as the inventor, and yet has no means of obtaining a monopoly on his ideas. It is also true, as Mr. Fish states, that in many cases inventions are only valuable as incidents to the manufacturer and cannot be segregated and appraised separately. Others may have contributed to making an invention possible, and others may contribute to making it profitable, and it is impossible to segregate the value accruing to any individual inventor. He believes that something should be done in regard to the method of examination, as the waste of time in taking direct and indirect testimony is something unbearable.

Dr. C. P. Steinmetz in taking the floor said that he had made a few inventions himself, and that the direct financial gain which he had from all of his inventions amounted to about $500. On the other hand, he believed that indirectly in salary and reputation, he had received at least the value of his inventions, so that he cannot find any fault personally with the protection accorded to inventors. He disapproved a suggestion which has been made that a limit of one or two years should

be set within which an invention should be worked; such a requirement would offer very little handicap to the manufacturer, who could arrange to have a boy put to work on the invention, while it would be fatal to inventors, since most of them are not able to manufacture an invention themselves, and therefore would have to turn it over to the manufacturer at any price, or lose it altogether. To interest capital, an invention must be a commodity which has a market value; it must be made evident how far the invention can control the industry or part of the industry to which it is related, and how good the chances are that the patent will be sustained finally in court. Even with these questions decided, a patent has a very uncertain value, because it may never develop its promises owing to unforeseen difficulties. Again, just as it began to develop and become profitable, someone may invent something like it, or when it is ready for commercial exploitation some inventor may accomplish the same purpose in a much simpler manner.

The inventor needs capital to develop his invention, while the capitalist does not need the inventor, and since the latter is the stronger, the control must lie with the capitalist, and not with the inventor. Thus it is not a question of morals, but the results of an economic condition. The situation very much more favorable to the inventor is with respect to an established manufacturing company which a patent affects, for the inventor can hold back his invention until it is needed by the manufacturer, and the latter has to come to terms, or, as is more commonly the case, the manufacturer will realize that the inventior offers a certain financial advantage in his field, and therefore is willing to share the advantage with the inventor. This is usually the method by which capital may be united with invention.

An inventor in some cases may be handicapped by the broad inventions of others, and thus be led to the idea that broad patents are objectionable; but he should realize that any limitation of a patent is an advantage to the exploiter of the invention and not to the inventor. If one is limited to a specific application, a patent is made worthless, and the inventor with a broad conception is deprived of the value of his work, since his first conception may be the crudest and least efficient, and further developments and modifications after the general method has been shown will naturally embody a better way of carrying it out.

If an inventor were debarred from the control of these later improvements the advantages of his invention would accrue to those who have improved in detail on his broad principle; this would not be fair, and would be very harmful to the value of inventions, because it would make it possible for one to reap the benefit by means of a modification of which the original inventor did not happen to think.

When an invention is finally adjudged by the court, and the ownership has left the original inventor, the outcome is of no moment to him, as he has no further financial interest in the question as to whether the invention is sustained or invalidated by the court. It should be realized that the invalidation of a patent by the court reduces the market value of all other inventions, while any patent broadly sustained increases the market value of all other inventions; consequently it is of especial advantage to the inventor to have his patent sustained, even though there is no immediate financial gain to him from that particular patent.

In considering the large manufacturer, the invalidation of a patent may destroy his monopoly in certain fields but at the same time would relieve him of the necessity of buying the control of the invention, and merely mean a readjustment of business methods without either gain or less. It is to the interest of all engineers to have patent law make every invention sufficiently broad to cover all modifications which may be of a fundamental idea, and have the patent sustained by the courts, because these are the two factors which make the market value of patents.

In closing the discussion, Mr. Fish agreed with Mr. Steinmetz that any provision requiring the working of an invention would be fatal to the inventor. He disagreed with the statement sometimes made that lawyers like to prolong litigation, which would be the most short-sighted policy imaginable on the part of the lawyer. In the case of himself and other lawyers the practice is to seek to stop litigation because of the expense and delay; if patent lawyers want big fees they should see that the method of procedure is simplified, so that they will not have to say to a client: "Yes, I think you have a good case, but I do not think you can afford to try it."

The one reform in the patent system most needed is the grant of more money to the Patent Office, which is the only department of the Government that is self-supporting. Mr. Fish said he was shocked and amused when he learned some years ago for the first time that to run the Patent Office of the United States cost about as much as to run one battleship; he now expects it costs two or three times as much to run a battleship as it costs to run the Patent Office. As to the cost of increasing judges, the Government of the United States cannot afford to expend on all the judges and all of the courts of the United States per year as much as is frequently involved in a single patent case. In the administration of the judicial system there is too little spent in proportion to the results of the interests involved. Mr. Fish disagreed with Prof. Crocker's statement that since patent cases all relate to science, three fair-minded men, or two fair-minded men, or even one fair-minded scientific man, should be able to settle a question. If anything like that were attempted the result would be even worse confounded, for unless the expert possessed judicial qualities his decision would not be good. Get an expert's presentation of the facts, he said, and then have a judge trained to decide controverted questions to pass upon the case.

Discussion of Technical Papers.

In a letter printed in several of our English contemporaries, Mr. Edward W. Cowan submits some suggestions on the subject of increasing the value of discussions of papers presented before the British Institution of Electrical Engineers. Might not, he asks all members desiring to take part in a discussion be required, when sending their names, to submit a very brief summary of, or at least the heads of, their proposed contributions? The president, having a list before him of the points which will be dealt with by each speaker, can "edit" the debate with due regard to the relative importance of the matter contribute rather than to his estimate of the importance of the matter which the speaker is capable of contributing. Thus interesting, but digressive discourse, may be curtailed, and time found for valuable contributions, some of which, though tendered, remained "ungotten" during the period of the last session. Of course, these contributions can always be sent to the *Transactions* to be printed. Instead of the author's reply being relegated to a few breathless minutes at or after closing time, it is asked if he might not be given an opportunity to reply at reasonable length to all the points of criticism which lend themselves to verbal treatment. The meeting wants to hear the author's defence. Debate has lost its best characteristic when criticism is not met with prompt reply. When papers lend themselves to such treatment it is suggested that their discussion might be "by compartments." The author or the editing committee could settle the divisions, and the president would introduce them to the meeting in the order of their importance to it.

With such an arrangement much confusion would be avoided, and, when time pressed, the points of relative unimportance would be crowded out instead of persons of relative unimportance. There would also be a great advantage from a "debate" point of view, if at least a few minutes were reserved for general discussion as distinct from the contributions of those who have sent in their names, and if the author was given an opportunity of replying on each point before the next one was presented for discussion.

CURRENT NEWS AND NOTES.

WIRELESS TELEPHONY OVER 60 MILES.—In a trial of wireless telephony off Toulon, between the French warship *Conde* and land stations, the voices of the operators at the telephones were heard distinctly over a distance of 60 miles.

CLEARANCE OF ELECTRIC LINES OVER RAILROADS.—On inquiry of a number of mill companies as to the clearance of overhead wires and cables, the Indiana Railroad Commission has ruled that under the Indiana law the distance of electric wires and cables should be elevated above railroad tracks at least 25 ft., and in no case less than 22 ft.

BASEBALL BY ELECTRIC LIGHT.—According to a dispatch from Cincinnati the experiment is to be made there of playing baseball at night by the aid of electric light. The local National League team will play a game with a picked team on the night of June 19. The ball park has been fitted up with electric-light towers and other devices for lighting the field.

AIRSHIP WITH WIRELESS.—Experiments were recently conducted in Berlin, Germany, on an airship wireless equipment. The trials lasted for some hours while the craft maneuvred over the roofs of the city. An attempt was made to put the instruments in tune with those at the wireless land stations. The army officers who controlled the airship, however, declined to make any statement as to the results obtained.

GIFT TO LEHIGH.—The veteran ironmaster and metallurgist, Mr. John Fritz, of Bethlehem, Pa., in whose honor a gold medal was founded on his eightieth birthday by the four great national engineering societies, has just given $50,000 to Lehigh University for an engineering laboratory, which will be thoroughly equipped. He has been a trustee for over 30 years.

GUIDE FOR TELEPHONE TALKS.—The New York Telephone Company has issued to its subscribers a neat 16-page pamphlet containing information designed to facilitate telephonic communication and, incidentally, lessen friction with "Central." "Conversation is an art in which a man has all mankind for competitors," is the quotation from Emerson which adorns the cover.

TELEGRAPHY AND HIGH-TENSION LINES.—Judge Tuthill, of the Laporte (Ind.) Superior Court, has denied an injunction asked by the Western Union Telegraph Company against the Chicago, Lake Shore & South Bend Traction Company, which operates a high-tension trolley system, to restrain the use of such system on the ground that the high-tension lines seriously affect the telegraph wires and render them useless at times.

ENGINEERING CODE OF ETHICS.—At the annual meeting in May of the British Institution of Electrical Engineers, it was announced that the council had under consideration the issuing of a statement on the subject of professional conduct, a matter which has also recently engaged the attention of the Institution of Civil Engineers. It will be recalled that a committee, of which Dr. S. S. Wheeler was chairman, prepared a similar code for the A. I. E. E.

MODEL LAMP POSTS.—In *Electrical World* of May 6 sketches were shown of new lighting fixtures for possible use in the parks. It appears that at the desire of the New York authorities these new posts had been copyrighted, but we were not aware of this fact and the word "copyrighted" was omitted from our reproductions. We hasten to correct this by directing attention now to the copyright covering all the excellent drawings and illustrations prepared for the purpose and for the recent exhibition of the Municipal Art Society on "City Planning and Municipal Art."

PHILADELPHIA SECTION, A. I. E. E.—The annual dinner of the Philadelphia section of the American Institute of Electrical Engineers was held on June 2 at the Hotel Poinsettia, on the Boardwalk, Atlantic City, when no fewer than 95 members attended. Mr. Paul Spencer, chairman of the section, presided, and brief speeches were also made by Dr. Franklin, Mr. W. A. Layman, of St. Louis, and Secretary Sanville. A most enjoyable time was had, and the large attendance was the more remarkable in view of the strong counter attractions of the electric light convention.

TELEPHONE LINES OF INDIANA ELECTRIC RAILWAYS.—The Indiana Railroad Commission's annual report just issued shows that 32 electric railroads operating in Indiana have constructed and equipped 2968 miles of telephone wire for the use of dispatching trains and conducting the business of these roads. The least number of miles of wire operated by any one road is 18.26 miles and the greatest number 959.22 miles. This total number of miles of telephone wire reported does not cover the whole number of miles used by traction roads operating in Indiana, about 10 roads having made no report on this subject.

GERMAN CABLE MAKERS' TRUST.—Several months ago the combination which had existed among German cable makers was dissolved in consequence of inability to arrive at an agreement with an outside competitor, the Bergmann Electricity Works Company, which had recently started the production of cables for lighting and power purposes. The rivalry which immediately ensued became so keen that the price of cables for heavy work declined, it is stated, even to 30 per cent less than cost of production. The result has been the announcement of the reconstitution of the trust with the addition of the former outstanding firm as a member—presumably on terms satisfactory to the latter. The price agreement will only apply to German consumers.

BRITISH I. E. S.—At the general annual meeting of the British Institution of Electrical Engineers last month the total roll of that body was reported as 6097, consisting of 7 honorary members, 1136 members, 2375 associate members, 1036 associates, 1438 students and 105 foreign members. Mr. Oliver Heavisides and Hon. Charles A. Parsons were added to the list of honorary members. During the past year there were 16 general meetings of the body, and 45 meetings of the local sections at Birmingham, Dublin, Glasgow, Leeds, Manchester and Newcastle. Among the numerous annual premiums, ranging in value from $25 to $125, one was awarded to Mr. J. S. Peck for a paper entitled "Flywheel Load Equalizer." The Institution will occupy its new building in the fall. Its benevolent fund at present amounts to $15,000.

STEVENS INSTITUTE EXPANSION.—For some time past the authorities of the Stevens Institute of Technology have realized that if it did not soon go forward it must go backward, and they have now taken a resolute step forward by securing an option on the famous Stevens property at Castle Point, Hoboken, overlooking the Hudson. The amount involved is about $1,500,000, and it is reported that the Carnegie Foundation and Rockefeller Educational Fund will help finance the project. President Humphreys is quoted as follows: "I am happy to say we have just obtained an option on the 'castle' and its grounds, and we are about to commence an active campaign to purchase this property, pay off the mortgage on the athletic field, pay off the debt still resting on the Morton Laboratory, erect a new shop and a laboratory of electrical engineering, and add sufficiently to our productive endowment to enable us to maintain this large plant."

Central-Station Practice and Results from Waterloo, Ia.

FROM the various short articles which have appeared from time to time regarding the practice of the Citizens' Gas & Electric Company, operating in the cities of Waterloo and Cedar Falls, Ia., many readers are probably aware that an unusually progressive and painstaking management is in force there. It is the purpose of the present article to go into this company's work in a more comprehensive manner than in previous articles.

In 1902 the electric light properties of Waterloo and Cedar Falls, two neighboring cities, were operated independently of each other. Mr. Austin Burt, who is now general superintendent of the company, was called upon by the owners of the property at Cedar Falls to plan changes and improvements in operating methods which would enable that company to show more of a balance on the credit side of the ledger. The outcome of this was the building of a transmission line to supply Cedar Falls from the Waterloo station, and the consolidation of the Waterloo and Cedar Falls properties. The combined population of the two cities at that time was about 25,000, that of Cedar Falls being 5000. Following this consolidation notable

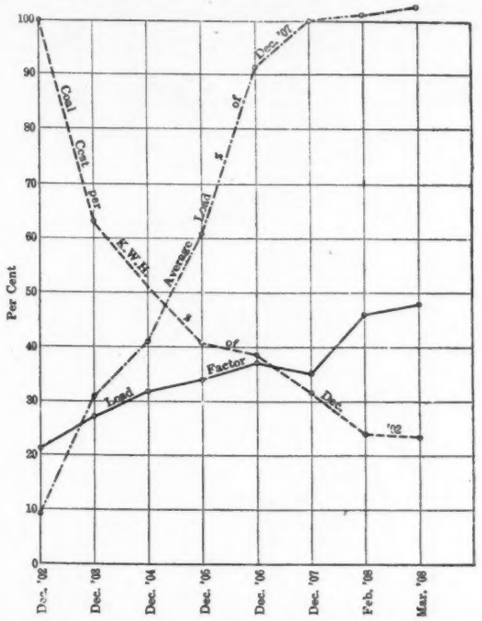


FIG. 1.—CURVES OF COAL COST AND LOAD FACTOR.

economies and developments took place which this article will describe.

During the period of these changes the station at Waterloo has been rapidly growing from one operated entirely with high-speed compound condensing engines to one in which much of the output is obtained from condensing steam turbines.

IMPROVEMENTS IN PRODUCTION COSTS.

In 1904 the station had a capacity of 433 kw in cross-compound, high-speed condensing engines. The load factor for the year—that is, the ratio of the average to the peak load—was only 13 per cent, which indicated a condition fatal to economy, on account of the light load at which the station was being operated most of the time. Aside from this question of load factor, however, the station records month by month for 1903 show a remarkable reduction in fuel costs and are interesting as indicating economies which are sometimes possible without any change in apparatus or character of load. This economy during the year 1903 was brought about by greater attention to details in the operation of the station, in securing good men, in operating units as fully loaded as possible, in keeping boilers clean, and in proper firing.

Since 1905 further reductions in cost per kw-hour have been brought about by the use of steam turbines, and by the improvement of the load factor through taking on a large amount of power business. The development of power business has, in fact, been one of the notable points about the Waterloo station.

This article would not be complete without reproducing here for study in connection with other data presented the two

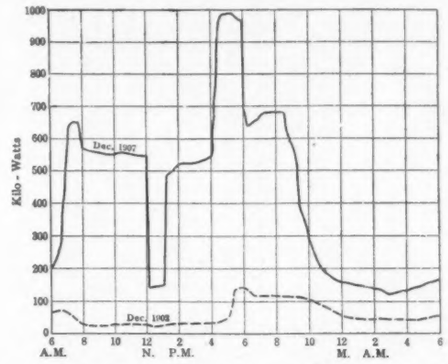


FIG. 2.—DECEMBER DAILY LOAD CURVES, 1902 AND 1907.

curves published in the issue of May 16, 1908, in connection with some remarks made by Mr. Burt before the Iowa Electrical Association convention. Fig. 1, which is taken from that article, shows how greatly the cost of coal per kw-hour has been reduced since December, 1902. The coal used per kw-hour in February and March, 1908, was only about 24 per cent of that used in 1902. Another interesting fact (not shown by this curve) is that the total cost of coal for the year 1908 was almost the same as that for the year 1907, while the output increased 367,000 kw-hours.

The increase in load is indicated by the typical December daylight load curves in 1902 and 1907, shown in Fig. 2, and also by the month-by-month output curves from 1902 to 1908, shown in Fig. 3. The improvement in load factor, shown by one of the curves in Fig. 1, is accomplished by the taking on of motor load.

POWER PLANT.

The power station is located on a large tract occupied by both the gas and electric plants on the bank of the Cedar River and with railroad tracks alongside. Fig. 4 shows the plan of the electric power station part of the property. Fig. 5 is an exterior view of the building showing the coaling facilities, buildings and stocks.

The present station capacity is about 2100 kw, normal rating. There are two condensing turbines: one of 1500-kw maximum rated capacity, shown in Fig. 6, and the other of 750-kw maximum rated capacity. There is also a 300-kw engine-type generator.

The turbines are equipped with Edwards air-pumps with

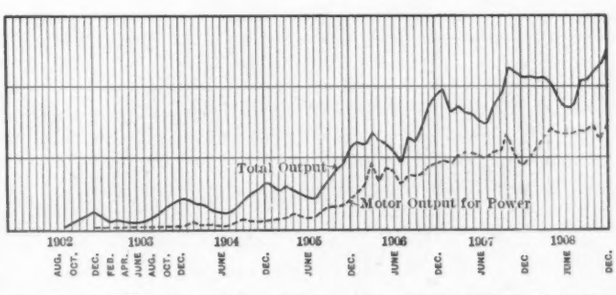


FIG. 3.—CURVES OF TOTAL OUTPUT AND POWER-FEEDER OUTPUT, 1902 TO 1908.

Wheeler condensers. One circulation pump is motor-driven and the other steam-driven. The motor drive is favored for circulating pumps, as there is enough steam from turbo-exciters, air-pump and feed-pumps for heating feed-water.

The plan has been rigidly followed in the growth of this station of getting the steam-turbine auxiliary apparatus on one

floor as nearly as possible. No apparatus is placed in the basement. The condenser pumps and oil and step-bearing pumps are all on the main floor. The beneficial effect of this is shown by the comparatively low cost of station labor.

Power-plant labor is performed by men working 10-hour shifts. There are three firemen, one of whom works as a helper six hours of his shift in the engine room. There are

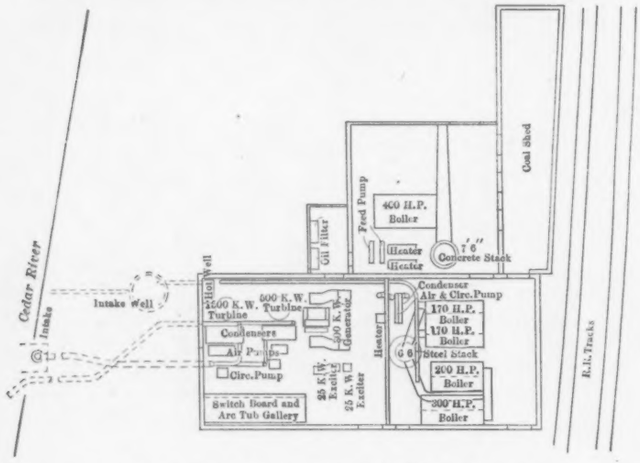


FIG. 4.—PLAN OF POWER-STATION PROPERTY.

two coal-passers and one man for boiler cleaning and repairs. In the engine room two engineers work 10-hour shifts and the chief engineer takes one four-hour run, with the helper. The entire power-house force is therefore nine men.

Excitation is furnished by two 25-kw Curtis turbines, direct-connected to exciters. All wires, including the 2300-volt lines, are run in iron-pipe conduit from the switchboard to the point where they leave the station on the opposite side of the turbine room. The step-up transformers for the Cedar Falls transmission are in a small brick room adjoining the turbine room. The 10,000-volt lines for this transmission leave directly

FIG. 5.—EXTERIOR OF STATION AND COALING FACILITIES.

from this transformer room and are kept independent of the 2300-volt pole lines.

The switchboard (Fig. 7), which was recently built, is more nearly complete than usually found in plants of this size. The generator panels are at the right end of the board and the feeder and arc panels at the left end. The totalizing panel in the middle is equipped with a curve-drawing wattmeter. The entire output is measured by recording watt-hour meters on the feeder panels. The power and lighting feeders are kept separate and are separately metered, so that the relative outputs for power and lighting purposes are known.

An interesting scheme used in connection with this board is that of having meter-testing terminals placed at the bottom of the feeder panels for calibrating the recording watt-hour meters. By means of these terminal posts a test meter can be

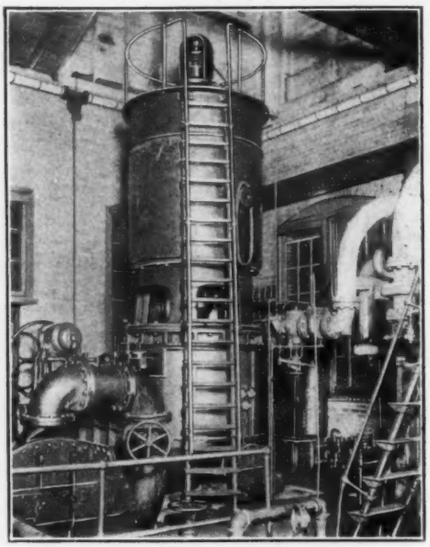


FIG. 6.—1500-KW TURBINE AND CONDENSER ON ONE FLOOR.

inserted in circuit so as to check the switchboard meter without interfering with the operation of the panel.

The field rheostats of the generators are of the "woodpecker" type, operated by ratchets with a reciprocating motion furnished by solenoids. The solenoid circuits are controlled by a push-or-pull switch which takes the place of the old rheostat handle on the switchboard. Pushing in operates the rheostat in one direction, while pulling out operates it in the opposite direction. The voltage regulation of the generators is provided for by a Tirrill regulator, which has a capacity for two 50-kw or four 25-kw exciter units.

Two of the single-phase lighting feeders are provided with double-pole overload relays. The object of this is to avoid the possibility of failure of a circuit-breaker to operate should a

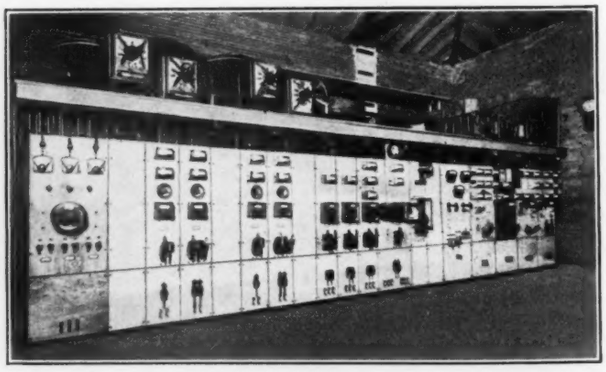


FIG. 7.—SWITCHBOARD WITH NEW FEATURES.

short-circuit occur between different single-phase lighting feeders which might not be protected were the relay inserted in only one leg of each single-phase circuit.

POWER-PLANT PERFORMANCE.

The yearly average for coal consumption is about 4.7 lb. per kw-hour. The coal used is from the Illinois Carterville district, and while it costs considerably more than that from the nearer Iowa fields, careful tests show it to be the lowest

in terms of cost per kw-hour. The total water evaporated per pound of coal averaged for the period of a month, without correction and with the present Illinois coal, about 6.3 lb. This coal costs in the bin about $2.93 per ton. With Iowa coal the evaporation was only 3.9 lb. of water per pound of coal. The difference in market price is not enough to make up for this difference in evaporation.

OVERHEAD LINES.

The distribution, which is all overhead, is in notably fine shape. Fig. 8 shows a typical example. All lines are run on Idaho cedar poles, varying in length from 35 ft. to 60 ft. All

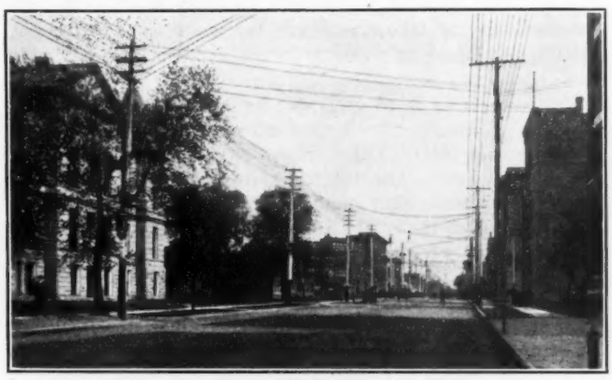


FIG. 8.—TYPICAL OVERHEAD WORK.

poles, which are white at the top and black near the bottom, have been painted twice in the past five years. A larger separation of wires than usual is employed in most cases. The present standard is to use 6-ft. cross-arms for four pins, 5-ft. arms having previously been used for four pins. For power feeders the usual three-wire, three-phase, 2300-volt system is used. Lighting feeders are 2300-volt, single-phase, taken from three-phase busbars at the power station.

A record of the overhead lines of the city is kept by means of sectional maps. There is one general reference map of the city, with various sections indicated upon it. For each of these sections there is a map on an enlarged scale upon which poles, street lamps and transformers are indicated. On these plans heavy lines indicate primary 2300-volt lines, light lines indicate three-wire secondaries and light dotted lines two-wire secondaries, transformers and lightning arresters being shown by suitable symbols.

TUNGSTEN STREET LIGHTING.

In lighting the streets of Cedar Falls, some arc lamps and 233 40-cp series tungsten lamps are used. These tungsten lamps operate from the regular arc circuit and take the place of the 32-cp carbon-filament lamps formerly used. The change to higher candle-power has been made by the company voluntarily, and the price remains the same as before—namely, $12 per year per lamp on a schedule calling for operation about 2300 hours. One lamp is placed at each street intersection.

METERING.

There are about 2200 meters on the system, divided between the latest General Electric and Westinghouse induction types. One man gives his time to meter testing, testing meters on consumers' premises at the rate of about 10 per day. A lamp bank is carried for an artificial load on the meter during the testing. The company is equipped with portable rotating standard meters, one of Westinghouse and one of General Electric manufacture.

The lost and unaccounted-for energy, not including the loss on the transmission between Waterloo and Cedar Falls, was 24.15 per cent of the energy measured at the switchboard for the year 1907. For the year 1908 this was reduced to 18.95 per cent. This marked improvement is believed to be due largely to increase in load factor of individual consumers and better loading of the transformer system, so that there are not so many underloaded transformers. This is considerably less loss than on most alternating-current systems.

On the transmission line between Waterloo and Cedar Falls, which is 7.75 miles long, operated at 10,000 volts, with No. 6 semi-hard-drawn copper line wires, the loss in step-up and step-down transformers and line for the year 1908 was 21.9 per cent of the energy transmitted. As this line is operated lightly loaded many hours per day, the transformer core losses amount to a much larger per cent of total energy supplied than if the line were better loaded. The capacity of the step-down transformers on this line is 225 kw.

POWER BUSINESS.

One of the notable things about the Waterloo company is the large amount of power supplied to small and large manufacturers. These installations run all the way from one to several hundred horse-power per consumer. This power business, and the good load factor it makes possible, is partly responsible for the economy of power production. The yearly load factor was raised from 13 per cent in 1902 to 32 per cent in 1908.

In Fig. 2 are shown two curves, one of which gives the total output month by month in kw-hours for several years, and the other shows the output for power purposes. From this it is seen that the output for power in 1908 is a much greater proportion of the total than in 1903, and is now much higher than in the ordinary plant.

In 1908 the percentages of output for various purposes, as measured at the switchboard, were as follows:

	Per cent.
Street lighting	9.1
Commercial lighting	34.3
Power	54.5
Loss on Cedar Falls transmission	2.1
	100.0

NON-PEAK POWER.

The company has begun to take on power consumers under off-peak contracts, whereby the company can require the consumers to shut down their motors between the hours of 4 and 6 p. m. during the months of November, December, January and February, or if used during that period, to pay regular rates for all electricity supplied during the preceding 12 months. The company will not exercise this right unless it needs its capacity for carrying its regular peak business. It is only recently that the company has adopted this plan, but it already has 380 hp in motors connected under such contracts. The rates are considerably below those given regular consumers as regards the

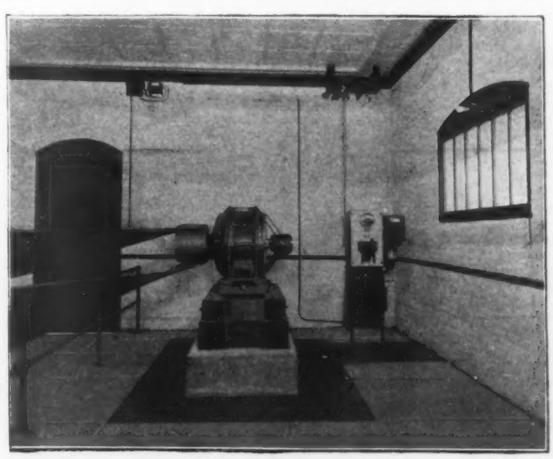


FIG. 9.—MOTOR AND DEEP-WELL PUMP STATION.

first few hours' use per month of the connected load. Otherwise they are about the same.

WATER-WORKS PUMPING.

Among the off-peak contracts which the company has taken is that for pumping water at one of the deep-well pumping stations of the Waterloo Water Company. The deep-well pump used in this case is of the vertical-shaft, centrifugal type,

built by the Byron Jackson Machine Works, at San Francisco. This pump is placed 200 ft. below the surface. It is of small diameter, being placed within a 16-in. outside diameter well casing, ⅜ in. thick. Outside of this inner casing there is a 20-in. outside diameter casing. The pump runs 850 r.p.m.

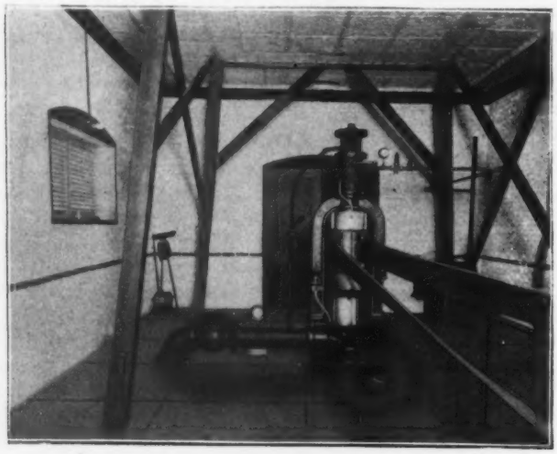


FIG. 10.—BELTED VERTICAL CENTRIFUGAL DEEP-WELL PUMP.

against an effective head of 78 ft., 60 of which is due to water lift and 12 to friction. This head varies somewhat, however, from day to day. The pump runs 850 r.p.m. and pumps 824 gal. per minute, or 1,200,000 gal. per day. It was installed under the supervision of Mr. C. R. Henderson, chief engineer of the Waterloo Water Company. On account of the uncertainty as to what would be the depth of water in the well and the consequent desirable speed, this pump was not direct-connected to a vertical-shaft motor, but was belted to the ordinary horizontal-shaft motor. The installation is shown in Figs. 9 and 10, which also show the interior of the pump house erected at this well. The exterior of the pump house is shown in Fig.

FIG. 11.—EXTERIOR DEEP-WELL PUMPING STATION.

11. This pump operates practically all of the time, except when the central-station company desires the capacity which it takes for other purposes during peak load. As with other off-peak contracts, it is allowed to operate during peak load as long as the company has sufficient reserve capacity to take care of it.

RATES.

The lighting rates are 16 cents per kw-hour for energy supplied in excess of the turning point, less a discount of 1 cent per kw-hour if the bill is paid on or before the 10th of the month. The turning point is practically determined by the number of hours' use per month which the customer has made of his connected load. For lighting installation in commercial use this turning point is fixed at 2 kw-hours per socket connected, to which 6 kw-hours is added as a kind of service charge. In residences, installations of 10 lamps or less are counted as if they were four lamps. Twenty lamps or less are counted as five lamps. Above 20 lamps, 1 kw-hour is added for each 10 lamps installed. There is a schedule of minimum rates for residences as follows: Seven lamps, 50 cents; 13 lamps, 75 cents; 20 lamps, $1; over 20 lamps, 15 cents for each additional 10 lamps.

The power rate is 10 cents per kw-hour up to the turning point and 3 cents per kw-hour for current supplied in excess of the turning point. The discount for prompt payment is ½ cent per kw-hour. The turning point is reached on a 1-hp motor installation when 70 kw-hours per month have been consumed. Thus the rate would be 10 cents per kw-hour up to 70 hours, and 3 cents per kw-hour in excess of 70 hours. Motors of from 1 hp to 10 hp have 40 kw-hours added for each horse-power to make up the turning point. Motors of 10 hp to 30 hp have 30 kw-hours added per horse-power to make up the turning point. There is a minimum bill of $1.50 per rated horse-power, which is rigidly adhered to.

It will be seen by analysis of these rates that on lighting installations they are figured so that the consumer must use the equivalent of his connected load, 35 hours per month, before he reaches the turning point, beyond which he gets a low rate. On a motor installation this varies according to the size of the motor, but is approximately the same.

The property is one of those controlled by the Dawes syndicate of Chicago. The president and general manager is Mr. I. C. Elston, Jr. Mr. Austin Burt, past-president of the Iowa Electrical Association, is general superintendent, under whom the electrical department has been brought to such a high state of efficiency.

An Exact Method for the Determination of the Efficiency, Regulation or Size of Transmission Conductors.

By Harold Pender.

IN view of the number of articles that have recently appeared on the calculation of transmission lines, giving various approximate formulas for this purpose—some of which may, under certain conditions, give quite erroneous results—the following exact formulas for the calculation of the various quantities from any set of premises that may be given should prove of interest. Except for the determination of the size of wire to be used for a given voltage drop the solution in each case is found directly by means of a comparatively simple formula; to determine the size of wire for a given drop, an approximation is first obtained and then the error involved in the approximation is determined; this error, however, will be found negligible in most practical cases. Moreover, the use of this particular approximate formula followed by a determination of the error involved, has a distinct advantage, since a large error immediately indicates that the drop for any size of wire within a wide range will differ only slightly from the permissible drop, and that therefore, either by allowing a slight increase in the drop, or by employing two separate circuits instead of one, a very considerable saving in copper can be effected.

All of the formulas given are readily derivable from the usual diagram of two impedances in series, namely, the impedance of the load and the impedance of the line—remembering that the ratio of power lost to power delivered is equal to

the ratio of line resistance to the load resistance, and that the ratio of the voltage at the generating end to the voltage delivered is equal to the ratio of the total impedance to the load impedance.

In addition to the formulas, complete data for the resistance, reactance, capacity susceptance, weight, etc., for both copper and aluminum stranded wires are given in the accompanying tables, for any size of wire likely to be used for energy transmission. The reactance tables will be found particularly convenient, as

TABLE I.

REACTANCE PER MILE OF A NO. 4-0 B. & S. WIRE = x_1.

Distance apart of wires in feet.	15 Cycles.	25 Cycles.	40 Cycles.	60 Cycles.	125 Cycles.
1.....	0.128	0.213	0.340	0.510	1.063
2.....	0.149	0.248	0.396	$.594	1.328
3.....	0.161	0.268	0.429	0.644	1.341
4.....	0.170	0.283	0.452	0.678	1.413
5.....	0.176	0.294	0.470	0.705	1.470
6.....	0.182	0.303	0.485	0.728	1.516
7.....	0.187	0.311	0.498	0.746	1.555
8.....	0.191	0.318	0.508	0.763	1.589
9.....	0.194	0.324	0.518	0.777	1.618
10.....	0.197	0.329	0.526	0.790	1.645
15.....	0.210	0.350	0.559	0.839	1.748
20.....	0.218	0.364	0.582	0.874	1.820
25.....	0.225	0.375	0.601	0.901	1.877

they show directly the reactance per mile of any size of wire from 1,000,000 circ. mil to a No. 6 B. & S. wire, for any spacing from 1 ft. to 25 ft. and for frequencies of 15, 25, 40, 60 and 125 cycles per second. The tables are based on the fact that the reactance of a wire for a given frequency can be considered as the sum of two quantities, one varying only with the spacing of the wires and the other only with the size. The resistances have been calculated for copper of 98 per cent conductivity and for aluminum of 62 per cent conductivity (Matthiessen's Standard—that is, one meter-gram of soft-drawn copper = 0.141729 international ohm at 0 deg. C.), both at 20 deg. C., plus an increase of 1 per cent on account of stranding, the temperature coefficient being taken as 0.42 per cent per degree Centigrade. The weights are the weights of solid wire of equal cross-section increased by 1 per cent on account of stranding.

Let E = pressure between adjacent wires at receiving end in kilovolts.

V = pressure between adjacent wires at the generating end in kilovolts.

W = power delivered in megwatts (thousands of kilowatts).

k = power factor of the load, expressed as a decimal fraction = $\cos\theta$.

$t = \tan\theta$ corresponding to $k = \cos\theta$. (Table III.)

k_0 = power factor at the generating end, expressed as a decimal fraction.

L = in case of a three-phase system, the length of each wire in miles; in the case of a single-phase system, the total length of both wires in miles.

r = resistance of each conductor per mile.

$x = x_1 + x_2$ = reactance of each conductor per mile, where x_1 is the reactance per mile of a No. 4-0 B. & S. wire (Table I) and x_2 the difference in the reactance per mile of a No. 4-0 B. & S. wire and that of the wire actually used (Table II).

Q = power lost in transmission, as a fraction of the delivered power.

P = pressure drop, as a fraction of the delivered pressure.

$R = \dfrac{(kE)^2}{LW}$ = equivalent resistance of receiver per mile of line.

$T = t + \dfrac{x}{R}$

Case I.—Given the delivered pressure E, the power delivered W, the power factor of the load k, the length of the line L, the frequency and the allowable power loss Q. The size of wire to be used is determined by the following exact formulas[1]:

Power loss $$Q = \frac{r}{R}$$

Pressure drop $$P = k\sqrt{(1+Q)^2 + T^2} - 1$$

Power factor at generating end $$k_0 = \frac{1+Q}{1+P}k$$

Case II.—Given the delivered pressure E, the power delivered W, the power factor of the load k, the length of the line L, the frequency and the allowable power loss Q. The size of wire to be used is determined by the following exact formula:

$$\text{Resistance of each wire per mile, } r = RQ,$$

the corresponding size of wire being given in Table II. The pressure drop and power factor at the generating end can then be determined by the formulas given in Case I.

Case III.—Given the delivered pressure E, the power delivered W, the power factor of the load k, the length of the line L, the frequency, the spacing of the wires, and the allowable pressure drop P.

An exact determination of the size of the wire to use in this case cannot be made directly, since this would require the solution of a logarithmic equation. However, since the reactance of commercial sizes of wire for a given frequency and spacing differ only slightly from one another, a close approximation to the exact size of wire to be used can be obtained by assuming that the reactance, for a given frequency and spacing, for any size between 1,000,000 circ. mils and a No. 6 B. & S. wire is equal to that of a No. 4-0 wire. It will be found that except when the line reactance is large compared to the line resistance, the error due to this assumption will not cause a change in the size of wire—that is, the error will be less than half the percentage difference—26 per cent—between successive sizes on the B. & S. gage. On the other hand, as stated above, a large error in the

TABLE II.

RESISTANCE PER MILE OF COPPER AND ALUMINUM STRANDED WIRES AND REACTANCE INCREMENT** x_2.

Size circ. mils. and B. & S.	Ohms per mile at 20° C.* Copper.	Alum'm.	Difference** in reactance per mile of any size wire and that of a No. 4-0 B. & S. wire = X_2. 15 Cy.	25 Cy.	40 Cy.	60 Cy.	125 Cy.
1,600,000	0.0566	0.0894	—.024	—.039	—.063	—.094	—.196
900,000	0.0629	0.0993	—.022	—.037	—.059	—.088	—.183
800,000	0.0707	0.1118	—.020	—.034	—.054	—.081	—.168
700,000	0.0808	0.1278	—.018	—.030	—.048	—.073	—.152
600,000	0.0943	0.1490	—.016	—.026	—.042	—.063	—.132
500,000	0.1131	0.1788	—.013	—.022	—.035	—.052	—.109
450,000	0.1257	0.1987	—.011	—.019	—.031	—.046	—.095
400,000	0.1414	0.224	—.010	—.016	—.026	—.039	—.080
350,000	0.1616	0.255	—.008	—.013	—.020	—.031	—.064
300,000	0.1886	0.298	—.005	—.009	—.014	—.021	—.044
250,000	0.226	0.358	—.003	—.004	—.007	—.010	—.021
No. 0000	0.267	0.423	.000	.000	.000	.000	.000
000	0.337	0.533	+.004	+.006	+.009	+.014	+.029
00	0.425	0.672	+.007	+.012	+.019	+.028	+.059
0	0.536	0.848	+.011	+.018	+.028	+.042	+.088
1	0.676	1.068	+.014	+.023	+.038	+.056	+.117
2	0.852	1.347	+.019	+.029	+.047	+.070	+.147
4	1.355	2.14	+.025	+.041	+.066	+.098	+.205
6	2.15	3.41	+.032	+.053	+.084	+.127	+.264

*Stranded wire, copper 98 per cent, aluminum 62 per cent conductivity, resistance increased 1 per cent on account of stranding; temperature coefficient, 0.42 per cent per degree Centigrade.

**The total reactance of a wire for any spacing and frequency is $x = x_1 + x_2$, where x_1 is the reactance of a 4-0 wire under the same conditions.

approximate formula for the size of wire indicates immediately that the drop is due chiefly to the line reactance, and that by allowing a very small increase in the permissible drop,

[1]These formulas can also be used to determine the over-all efficiency, regulation and power factor of any number of circuits in series—for example, line and transformers—if r and x be allowed to represent the sum of the component resistances and reactances respectively and R the total equivalent resistance of the receiver.

or by employing two separate circuits instead of one, a very considerable saving in copper can be effected.

Put

$$T_1 = t + \frac{x_1}{R}$$

Where x_1 is the reactance of a No. 4-0 wire (Table I). Then, to a close approximation,

Resistance of each wire per mile:

$$r_1 = R\left[\sqrt{\left(\frac{1+P}{k}\right)^2 - T_1^2} - 1\right]$$

the corresponding size of wire being given in Table II, as well as the difference x_2 between the reactance corresponding to this size and the reactance of a No. 4-0 wire.

By substituting for T_1 in the above formula the value $T = T_1 + \frac{x_2}{R}$ the error in the value of r caused by neglecting x_2 can be readily found. As stated above, in any practical case this will, as a rule, be negligible; however, should the error in the particular problem in hand be sufficient to give a new value for r for which the corresponding value of x_2 differs appreciably from the first value found, r should be again calculated, using this second value for x_2, and so on, until the difference in x_2 for two successive values of r as thus determined becomes negligible. In this way an exact determination of the size corresponding to the given drop can readily be made, although, as stated above, a large error in the first approximation immediately indicates that the feasibility of increasing the permissible drop or of dividing the circuit should be investigated.

TABLE III.

VALUES OF t = TAN θ CORRESPONDING TO k = COS θ.

k.	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.5..	1.732	1.687	1.643	1.600	1.559	1.519	1.479	1.442	1.404	1.368
0.6..	1.333	1.299	1.265	1.233	1.201	1.169	1.138	1.108	1.078	1.049
0.7..	1.020	0.992	0.964	0.936	0.909	0.882	0.855	0.829	0.802	0.776
0.8..	0.750	0.724	0.698	0.672	0.646	0.620	0.593	0.567	0.540	0.512
0.9..	0.489	0.456	0.426	0.395	0.363	0.329	0.292	0.251	0.203	0.143

NOTE.—This table is to be used like a table of logarithms; that is, the value of t corresponding to $k = 0.83$ is 0.672.

Case IV.—Given the pressure at the generating end V, the power delivered W, the power factor of the load k, the length of the line L, the frequency, the size and spacing of the wires.

In this case R, the equivalent resistance of the receiver per mile of line, can be expressed in terms of the pressure at the generating end V.

Put

$$M = \frac{(kV)^2}{2LW} - (r + xt)k^2$$

$$e = \frac{k^2(r^2 + x^2)}{M^2}$$

Then

$$R = M[1 + \sqrt{1 - e}].$$

Using this value for R, the exact formulas given under Case I are immediately applicable.

Effect of Line Capacity.

The exact formulas for determining the effect of line capacity on the power loss and pressure drop are comparatively complicated. However, since the effect is usually small in such cases as arise in practice, a sufficiently close approximation can be obtained by assuming that the effect is the same as would be produced by two condensers, each having a capacity equal to one-half that of the line, shunted across the line at the receiving and sending ends respectively. The effect of the condenser at the receiving end is merely to modify the equivalent load power factor; the condenser at the sending end has no effect on the power loss and line drop, but merely increases the resultant power factor at the generating end.

In addition to the above symbols let

b = capacity susceptance[1] per mile of two parallel wires for a frequency of one cycle per second.

$B = nbL$ for a *three-phase* line or $\frac{nbL}{4}$ for a *single-phase* line, where n is the number of cycles per second, and L, as defined above, is the length in miles of *each* wire for a *three-phase* line or the length of *both* wires for a *single-phase* line.

Then the equivalent power factor at the receiving end is the cos k' corresponding to the tangent t', where

$$t' = t - \frac{BE^2}{W}$$

The above formulas for power loss and pressure drop (Case I) are then immediately applicable by substituting for k and t the values k' and t'; the formula for predetermining the size of wire in terms of the pressure drop (Case III) may also be applied, assuming the capacity susceptance equal to that of a No. 4-0 wire, an assumption which will introduce only a slight error, since the capacity susceptance varies only slightly with the size of wire. The power-factor formula, $k_o = \frac{1+Q}{1+P}k'$, (see Case I) gives the power factor at the generating end *excluding* the second condenser, the actual power factor at the generator is the cosine k'_o corresponding to the tangent t'_o where

$$t'_o = t_o - \frac{BV^2}{W_o}$$

where $W_o = (1 + Q)W$, the total power supplied at the generating end.

Alternating-Current Trolley Wires.

The resistance and reactance of various combinations of overhead trolleys and 100-lb. return rails are given in Table VI. This table is based on extended tests made by Mr. A. W. Copley on the New York, New Haven & Hartford Railroad, the results of which were published in the *Proceedings* of the American Institute of Electrical Engineers for December, 1908. Unfortunately there are no reliable data on rails of smaller section. However, since the greater part of the resistance is in the trolley, and only a small percentage of the total reactance is due to the magnetic field in the rail, the values given for the combined resistance and reactance, respectively, may also be used with but a slight error in case the rail is of smaller size. It should be noted that the reactances for the three sizes of wire given are constant to within 5 per cent for any height from 15 ft. to 30 ft. above the track.

The figures showing the division of current between the track and the earth refer to intermediate portions of long

TABLE IV.

SIZE AND WEIGHT OF STRANDED COPPER AND ALUMINUM WIRES.

Size B & S.	Circ. Mils.	Diameter Inches.	Lbs. per Mile* Copper.	Lbs. per Mile* Aluminum.
....	1,000,000	1.152	16,140	4,870
....	900,000	1.092	14,530	4,380
....	800,000	1.035	12,910	3,890
....	700,000	0.963	11,300	3,410
....	690,000	0.891	9,690	2,920
....	500,000	0.819	8,070	2,430
....	450,000	0.770	7,260	2,190
....	400,000	0.728	6,460	1,947
....	350,000	0.679	5,650	1,703
....	300,000	0.630	4,840	1,460
....	250,000	0.590	4,040	1,217
0000	211,600	0.530	3,420	1,030
000	167,800	0.470	2,710	817
00	133,100	0.420	2,150	648
0	105,500	0.375	1,703	513
1	83,690	0.330	1,351	407
2	66,370	0.291	1,071	323
4	41,740	0.231	674	203
6	26,250	0.183	420	128

*Increased 1 per cent over weight of solid wire on account of stranding.

[1] $b = 2\pi C$ where C is the capacity in farads of the condenser formed by unit length of each pair of line wires.

sections—more than three miles; a greater portion of the current flows in the track near the load and the power house. The division of current between rails and earth also depends on the character of the soil; for rocky or dry soil less current would probably return through the earth. It will be noted that if p' be the ratio of the current in each trolley to the total current and p'' the ratio of the current in each rail to the total current, and the respective resistances be r' and r'', the total resistance of any combination of trolleys and rails, as measured by Mr. Copley, is approximately $p'r' + p''r''$; similarly the total reactance is $p'x' + p''x''$ where x' and x'' are the reactances of a single trolley and rail, respectively; using these formulas, a closely approximate value for the equivalent resistance and reactance for any other combination of trolleys and rails for any division of current between the wires spaced 4 ft. apart. To find the power loss, pressure drop and power factor at the generating end, use should be made of the following values:

$$E = 40$$
$$W = 5$$
$$k = 0.8$$
$$t = 0.75$$
$$L = 30$$
$$r = 0.852$$
$$x = 0.283 + 0.029 = 0.312$$
$$R = \frac{(0.8 \times 40)^2}{30 \times 5} = 6.83$$
$$T = 0.75 + \frac{0.312}{6.83} = 0.796.$$

TABLE V.

CAPACITY SUSCEPTANCE PER MILE OF TWO PARALLEL STRANDED AERIAL WIRES, FREQUENCY ONE CYCLE PER SECOND.

Size circ. mil and B & S.	SUSCEPTANCE BETWEEN WIRES $= b_1$. Distance apart of wires in feet. 1	2	3	4	6	8	10	12
1,000,000	8.3×10^{-8}	7.5×10^{-8}	6.8×10^{-8}	6.3×10^{-8}	5.8×10^{-8}	5.5×10^{-8}	5.3×10^{-8}	5.1×10^{-8}
500,000	8.3×10^{-8}	6.9×10^{-8}	6.3×10^{-8}	5.9×10^{-8}	5.4×10^{-8}	5.2×10^{-8}	4.9×10^{-8}	4.8×10^{-8}
250,000	7.5×10^{-8}	6.3×10^{-8}	5.8×10^{-8}	5.5×10^{-8}	5.1×10^{-8}	4.9×10^{-8}	4.7×10^{-8}	4.5×10^{-8}
No. 0000	7.4×10^{-8}	6.2×10^{-8}	5.7×10^{-8}	5.4×10^{-8}	5.0×10^{-8}	4.8×10^{-8}	4.6×10^{-8}	4.5×10^{-8}
1	6.6×10^{-8}	5.6×10^{-8}	5.2×10^{-8}	5.0×10^{-8}	4.6×10^{-8}	4.4×10^{-8}	4.3×10^{-8}	4.1×10^{-8}
6	5.8×10^{-8}	5.0×10^{-8}	4.7×10^{-8}	4.5×10^{-8}	4.2×10^{-8}	4.0×10^{-8}	3.9×10^{-8}	3.8×10^{-8}

NOTE.—The charging current per mile of *single-phase* line (2 miles of wire) is equal to $bnE \times 10^3$; for a *three-phase* line the charging current per wire per mile of line (3 miles of wire) is equal to $1.16 \times 10^3\ nbE$, where n is the cycles per second, E the *kilovolts* between wires.

rails and the earth can be obtained. In the case of a catenary suspension, a certain percentage of the overhead current is carried by the messenger cable; on account of the high effective resistance of a steel cable to alternating currents, this current will be quite small. (In a 7/16-in. messenger cable, carrying a No. 4-0 wire, Mr. Copley gives the messenger current as only 3.5 per cent of the total.)

To determine the power loss, pressure drop, etc., for a single-phase trolley system, the formulas given above under Case I are directly applicable by putting L equal to the distance in miles of the load from the power house—or substation—and r and x equal, respectively, to the combined resistance and reactance of the trolley and the track per mile, as given in Table VI. Similarly, the proper size of trolley for any given set of conditions can be determined by the formulas given under Case III, taking from Table VI the reactance per mile x (constant for the three sizes of trolley specified and usually employed), and selecting the size of trolley from Table VI corresponding to the value of the resistance per mile given by the formula

$$r = R\left[\sqrt{\left(\frac{1+P}{k}\right)^2 - T} - 1\right]$$

Numerical Examples.

Case I.—A load of 5000 kw at 80 per cent factor is to be delivered at 40,000 volts over a three-phase line of No. 2 B. & S. copper wire 30 miles long, frequency 25 cycles per second,

Then

Power loss $$Q = \frac{0.852}{6.83} = 0.125$$

Pressure drop $$P = 0.8\sqrt{(1.125)^2 + (0.796)^2} - 1 = 0.102$$

Generator power factor $$k_0 = \frac{1.125}{1.102} \times 0.8 = 0.817.$$

Case II.—A load of 5000 kw at 80 per cent power factor is to be delivered at 40,000 volts over a three-phase line of copper wire 30 miles long; allowable power loss, 12.5 per cent. The problem is to find the size wire to use.

$$E = 40$$
$$W = 5$$

TABLE VI.

RESISTANCE AND REACTANCE OF SINGLE-PHASE TROLLEY WITH 100-LB. RAIL RETURN.

No. of Tracks.	No. of Trolley Wires.	No. of Return Rails.	Percentage of Current Returning in Rail.	Resistance Ohms per Mile—No. 4-0 Trolley. 25 Cy.	15 Cy.	3-0 Trolley. 25 Cy.	15 Cy.	2-0 Trolley. 25 Cy.	15 Cy.	Reactance Ohms per Mile. 25 Cy.	15 Cy.
..	1	..	..	0.26*	0.26	0.33	0.33	0.42	0.42	0.38	0.23
..	..	1	100	0.16*	0.13	0.16	0.13	0.16	0.13	0.44	0.26
..	1	1	25	0.30	0.29	0.37	0.36	0.46	0.45	0.49	0.30
1	1	2	40*	0.29*	0.28*	0.36	0.35	0.45	0.44	0.47*	0.282*
2	2	4	58*	0.155*	0.15*	0.20	0.19	0.24	0.23	0.269*	0.161*
4	4	8	75*	0.086*	0.082*	0.11	0.10	0.13	0.12	0.168*	0.101*

NOTE.—The figures marked thus * are taken directly from Mr. Copley's paper; the others are derived from these. At the point where the current enters the rail Mr. Copley found that 70 per cent of the current starts toward the power house on a single-track road and similarly 87 per cent on a four-track road, in each case the rail current falling to the values given in the table in a distance of about three miles and from that point on remaining practically constant until near the power house.

$$k = 0.8$$
$$L = 30$$
$$Q = 0.125$$
$$R = \frac{(0.8 \times 40)^2}{30 \times 5} = 6.83$$

Then

Resistance per mile $r = 0.125 \times 6.83 = 0.854$,

whence from Table II the proper size is found to be No. 2 B. & S.

Case III.—A load of 5000 kw at 80 per cent power factor is to be delivered at 40,000 volts over a three-phase line of copper wire, 30 miles long, frequency 25 cycles per second, wires spaced

4 ft. apart, allowable pressure drop 10.2 per cent; to find the size wire to use.

$$E = 40$$
$$W = 5$$
$$k = 0.8$$
$$t = 0.75$$
$$L = 30$$
$$P = 0.102$$
$$x_1 = 0.283$$
$$R = \frac{(0.8 \times 40)^2}{30 \times 5} = 6.83$$
$$T_1 = 0.75 + \frac{0.283}{6.83} = 0.791$$

Then

Resistance per mile

$$r_1 = 6.83\left[\sqrt{\left(\frac{1.102}{0.8}\right)^2 - (0.791)^2} - 1\right] = 0.872$$

whence, from Table II, the nearest size wire is found to be No. 2 B. & S. The value of x_2 corresponding to $r_1 = 0.872$ is 0.029, which makes $T = 0.796$, and gives 0.854 as the corresponding value for r, showing that the error in the first approximation for r is less than 3 per cent.

The above example may also be used to illustrate an extreme case, in which the first approximation for r may be entirely erroneous, but by successive applications of the above formula a correct solution can be obtained.

Keeping the other conditions the same, suppose the frequency be increased to 125 cycles per second,

Then

$$x_1 = 1.413$$
$$T_1 = 0.75 + \frac{1.413}{6.83} = 0.957$$

First approximation

$$r_1 = 6.83\left[\sqrt{\left(\frac{1.102}{0.8}\right)^2 - (0.957)^2} - 1\right] = -0.060,$$

which shows that it is impossible to deliver power under the conditions stated, with a line having a reactance as great as that of a No. 4-0 wire.

As a second approximation, assume a reactance equal to that of a 500,000-circ. mil wire. The resistance per mile then works out 0.041 ohm, which is again too small a value for r, since the reactance corresponding to a wire having this resistance is less than that of a 500,000-circ. mil wire.

As a third approximation, assume a reactance equal to that of a 700,000-circ. mil wire. The resistance per mile then works out to 0.079 ohm, which is about 1 per cent less than that of the 700,000 circ. mil assumed. The nearest commercial size of wire corresponding to a drop of 10.2 per cent is then 700,000 circ. mil.

As a matter of fact, however, the drop for any size between a No. 4-0 wire and a 1,000,000-circ. mil wire would be substantially the same, as will be readily seen by calculating the drop for these two sizes by the exact formula of Case I, which gives a drop of 9.6 per cent for a 1,000,000-circ. mil wire and 13.0 per cent for a No. 4-0 wire, as against the 10.2 per cent specified. Therefore, by increasing the drop to 13.0 per cent, say, a saving of 70 per cent in copper could be effected. (Were the drop proportional to the resistance, the saving in the copper for the same increase in drop would be only 21.5 per cent.) Again, the use of two circuits of No. 2 wire each, would give a drop of only 9.5 per cent, and would effect a saving of 81 per cent in copper.

Case IV.—Take the example given under Case I, but assume the pressure at the generator 44,080 volts, the receiver pressure E being unknown.

Then

$$M = \frac{(0.8 \times 44.08)^2}{2 \times 30 \times 5} - (0.852 + 0.312 \times 0.75)^2 (0.8)^2 = 3.45$$
$$e = \frac{(0.8)^2 (\overline{0.852}^2 + \overline{0.312})^2}{(3.46)^2} = 0.044$$

Whence

$$R = 3.45\,[1 + \sqrt{1 - 0.044}] = 6.83,$$

which agrees with the value found in Case I. The power loss, voltage drop—as a fraction of the delivered e.m.f.—and power factor at generating end then work out the same as in Case I. The voltage drop as a fraction of the e.m.f. at the generating end is

$$\frac{P}{1+P} = \frac{0.102}{1.102} = 0.0926.$$

Effect of Capacity.

Take the example given under Case I. From Table V

$$b = 5.0 \times 10^{-5}$$

whence

$$B = 25 \times 30 \times 5.0 \times 10^{-5} = 3.8 \times 10^{-3}$$

and

$$t' = 0.75 - \frac{3.8 \times 10^{-3} \times (40)^2}{5} = 0.738$$
$$k' = 0.805 \text{ (Table III.)}$$
$$R = \frac{(0.805 \times 40)^2}{30 \times 5} = 6.91$$
$$T = 0.738 + \frac{0.312}{6.91} = 0.783$$

Then

Power loss $$Q = \frac{0.852}{6.91} = 0.123$$

Pressure drop $$P = 0.805\ \sqrt{(1.123)^2 + (0.783)^2} - 1 = 0.102$$
$$k_0 = \frac{1.123}{1.102} \times 0.805 = 0.821$$
$$t_0 = 0.683 \text{ (Table III.)}$$
$$t_0' = 0.683 - \frac{3.8 \times 10^{-3} \times (44.08)^2}{5.62} = 0.670$$

Generator power factor $k'_0 = 0.831$. (Table III.)

Alternating-Current Trolley Circuits.

Power of 2000 kw is to be supplied to a locomotive at 90 per cent power factor and 10,000 volts at a distance of 20 miles from the power house—or substation; No. 4-0 trolley, return circuit two 100-lb. running rails, frequency 25 cycles. The problem is to find the power loss, pressure drop and power factor at the power house.

$$E = 10$$
$$W = 2$$
$$L = 20$$
$$k = 0.9$$
$$t = 0.489$$
$$r = 0.29$$
$$x = 0.47$$

These values for r and x are on the assumption that only 40 per cent of the return current flows through the rails.

$$R = \frac{(0.9 \times 10)^2}{20 \times 2} = 2.05$$
$$T = 0.489 + \frac{0.47}{2.05} = 0.718$$

Then

Power loss $$Q = \frac{0.29}{2.05} = 0.141$$

Pressure drop $$P = 0.9\ \sqrt{(1.141)^2 + (0.718)^2} - 1 = 0.213$$

Power factor at power house $$k_0 = \frac{1.141}{1.213} \times 0.9 = 0.847.$$

Taking the reverse problem, suppose that it is desired to determine the size of trolley to use for a drop of 21.3 per cent between the power house and the locomotive, the other conditions being the same as given in the preceding example. Then by the formula under Case III,

Combined resistance per mile of trolley and track,

$$r = 2.05\left[\sqrt{\left(\frac{1.213}{0.9}\right)^2 - (0.718)^2} - 1\right] = 0.29$$

whence, from Table VI, the proper size of trolley is a No. 4-0.

Power Plant of University of Washington, Seattle, Wash.

By GEORGE H. TINKER.

OWING to the addition of several new buildings and to meet the constantly growing demands of the University of Washington, the vigorous State institution of learning at Seattle, Wash., it was found necessary to increase greatly the mechanical equipment, and for reasons of economy and convenience of operation, as well as for the advantages it would offer along educational lines, it was decided to build a complete new power plant for furnishing light, heat and power.

FIG. 1.—POWER-PLANT BUILDING.

The power-plant building, shown in Fig. 1, is located on the east side of the university campus, close to and overlooking Lake Washington, a large body of fresh water noted for its beautiful scenery. The building, which is of pleasing design and of modern brick and concrete construction, contains a complete equipment of modern mechanical devices for the economical generation of power, lighting, ventilating and heating and other requirements of a large educational establishment.

The power house is divided into engine and boiler-rooms, the latter being 46½ ft. x 41 ft. 4 in. in size, and provided with a brick chimney 54 in. diameter by 100 ft. high, erected on a concrete base.

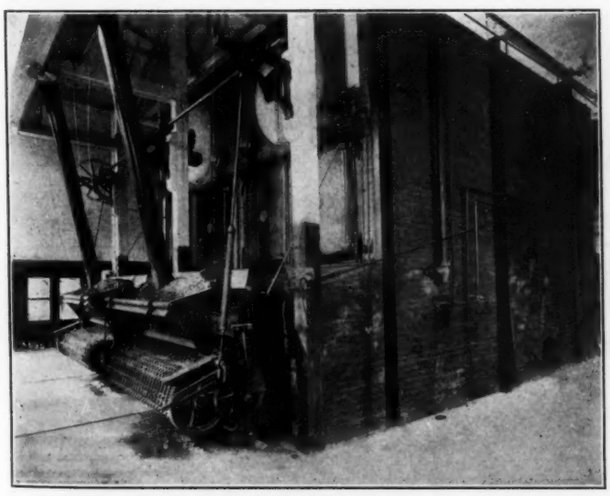


FIG. 2.—BOILER-ROOM.

A spur track of the Northern Pacific Railroad leads to the power plant, and coal is received in a concrete bin with a capacity of 500 tons. Coal is handled from the receiving bins to the bunkers, located above the stokers, by means of conveyors driven by a motor located in the building. There have been installed for present needs two Parker water-tube boilers set in one battery, each boiler having 2672 sq. ft. of heating surface and designed to operate at 160 lb. pressure. Pressed brick is used in the settings, which are laid in cement mortar. A grate area of 58½ sq. ft. active surface in a Green chain-grate stoker is provided in each boiler. (Fig. 2.) Almost perfect combustion is obtained in the regular operation of this plant, and it is only on very rare occasions, due to starting fire under boilers or something similar, that any smoke is visible. The driving power for the stokers is furnished by a small vertical Hallidie engine set on a light steel platform overhead, the engine being belted to a shaft over the stokers, which are eccentric driven.

As stated before, the coal is unloaded in the receiving bin. It is then elevated to the bunkers over the boilers, which have a capacity of 30 tons; from each a delivery spout, provided with cut-off gate, serves the coal to each stoker. The coal conveyor is driven by a 5-hp Westinghouse motor, with a starting box located on the boiler-room floor.

From the chain grates the ashes drop into a concrete tunnel under the boilers, from where they are "sluiced" out through the east wall of the boiler house and through a chute down the lake bank. Water is pumped by electric power from Lake Washington for the requirements of the university. But a surprisingly small quantity is required to "sluice" the ashes away, and as the water valves and nozzles are located in the boiler-room this makes an altogether convenient, clean and inexpensive method of getting rid of all ashes.

The boiler-feed water is mainly secured from the returns of the heating system, augmented when necessary from Lake Washington. A 750-hp Cochrane feed-water heater and receiver is provided, which is located in a corner of the boiler-room. The feed pumps are shown in Fig. 4. An average temperature of 210 deg. is maintained in the heater.

THE ENGINES.

The engine-room presents a pleasing appearance. It is 32 ft. 3 in. x 46½ ft. in size, with lofty ceiling and plenty of light and ventilation. The floors are of concrete with smooth, hard finish.

Two horizontal, simple-generating units are installed, consisting of Ridgway engines, direct-connected to 100-kw and 200-kw generators, respectively. (Figs. 3 and 4.) Each engine is fitted with Ridgway improved tank-oiling system and Hills-McCanna lubricating devices, with nickel-plated piping. Two complete sets of Thompson steam-engine indicators, with reducing motion, all in handsome hardwood cases, are provided. The

FIG. 3.—VIEW OF ONE CORNER OF ENGINE-ROOM.

engines are fitted with a complete synchronizing mechanism operating on the "Begtrup" inertia governors for adjusting speed from the switchboard.

The generators are of the Westinghouse alternating-current rotating-field, engine-type, three-phase, 60-cycle machines and operate in parallel at 2300 volts. The rotating parts are built upon a spider, which is solid and arranged to be pressed on the engine shaft. The external frame is solid and movable parallel to the shaft to allow of access to the windings, as can be noted in Fig. 4. The armatures of these machines are of the slotted-drum type, and the core is built of laminated steel of high magnetic quality. Throughout the armature spider, core and windings large and open ventilating ducts are provided, the design being such as to set up a forced circulation of air through these ventilating spaces. During the rigid test of the plant, continuing through several days, frequently with 50 per cent overload, these generators, as also the engines, ran remarkably cool.

The switchboard, consisting of seven panels, the rear of which is shown in Fig. 5, was also furnished the contractors by the Westinghouse Electric & Manufacturing Company. It is located in the engine-room and consists of seven panels, all of which are 24 in. wide by 96 in. high, except the two generator panels, which are 32 in. wide. All oil switches and circuit breakers are mounted separately back of the board, the operating handles only being mounted on the panels, connections being made by bell cranks and connecting rods.

The switchboard is arranged for the control of two 125-volt exciters, one the 100-kw and 200-kw generators previously described, seven single-phase lighting feeder circuits and three three-phase power-feeder circuits. All alternating-current instruments for the 2200-volt circuit are provided with series transformers, and all shunt instruments, such as voltmeters,

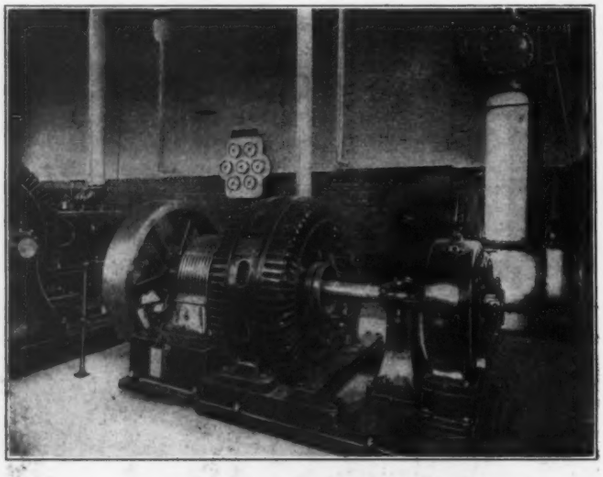


FIG. 4.—VIEW OF ONE OF THE GENERATORS.

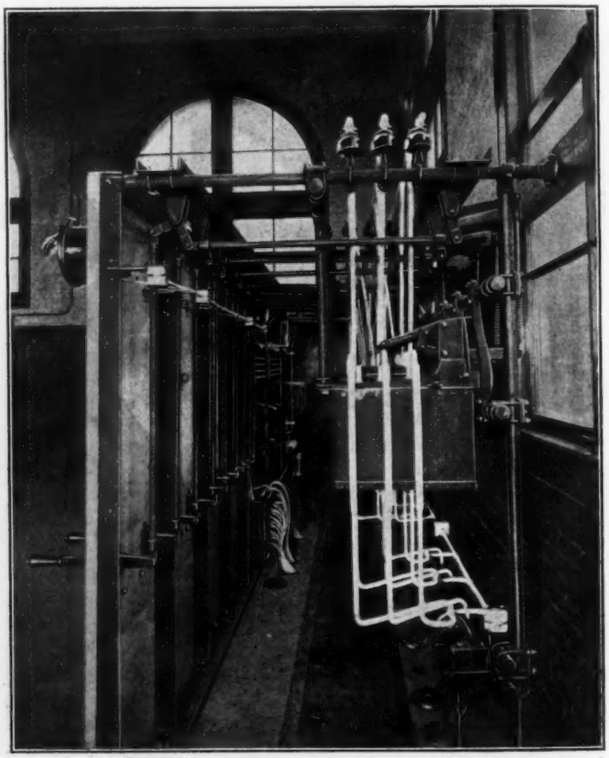


FIG. 5.—VIEW OF REAR OF SWITCHBOARD.

synchroscope and power-factor meters, are provided with shunt transformers.

All wiring for the generators, exciters, switchboards, etc., are placed in trenches with removable steel covers, and all the circuits leading to the various university buildings are installed in underground ducts, lead-covered cable being used. There are three 75-kw oil-cooled subway transformers with water-tight cases installed in concrete pits.

The entire power-plant equipment, including heating and return mains, electric circuits, etc., was installed by the Hallidie Machinery Company, of Seattle and Spokane, Wash., under the personal supervision of Mr. H. L. Weber, the contractor's superintendent of construction. Howard & Galloway, of San Francisco, Cal., were the supervising architects.

The appropriation made by the Washington State Legislature provided for the construction of several other permanent buildings besides the power house, to be used by the Alaska-Yukon-Pacific Exposition and subsequently to revert to the University of Washington. One of these buildings, Machinery Hall, will be occupied by the engineering college and in addition to classrooms, drafting-rooms and offices, will contain the testing laboratories of the department of civil engineering, the steam laboratory of the department of mechanical engineering, and the laboratories of the department of electrical engineering.

The mechanical laboratory will contain a McEwen cross-compound engine; a McEwen single-cylinder engine; a Murray-Corliss engine; a Ball engine; a Foos gas engine and a De Laval steam turbine. Besides these principal machines the equipment consists of condensers, gages, indicators, gas apparatus, barometers, thermometers, pyrometers, steam calorimeters, fuel calorimeters, speed indicators, brakes, air compressors, air-brake outfit, and such devices as may be necessary for testing and calibrating the apparatus used.

The electrical laboratory is equipped with generators and motors for both direct and alternating current. In the direct-current section are located machines of the Westinghouse, General Electric, Bullock and Western Electric manufacture. Lamp-banks, switchboard, rheostats, storage batteries and other necessary apparatus are provided. In the alternating-current section are located a two-phase and a three-phase Fort Wayne generator; a three-phase Westinghouse rotary converter; Wagner, General Electric and Bullock single-phase and three-phase induction motors and a three-phase Fort Wayne synchronous motor; also transformers, lamp-banks, switchboards and numerous meters. The electric equipment of the power house formerly occupied will be added to these laboratories.

Near the Engineering Building and the new power house will be located the shops of the mechanical engineering department, which will include departments in wood-working, machine-shop and foundry practice. The foundry portion of this building will be equipped with a Whiting cupola, a Steele-Harvey brass furnace, crane, core ovens, mill, rattler, shaker, riddles, core machines and molding machines and other accessories. One wing of this building will contain a forge shop. The entire equipment of the pattern shop and machine shop will be moved to different portions of this building.

Report of the N. E. L. A. Committee on Grounding the Secondary.

The report presented at the Atlantic City N. E. L. A. convention by the committee on grounding of secondaries opens with a quotation of the resolution of last year recommending that the National Electrical Code shall make the grounding of alternating-current secondaries mandatory up to voltages of 150, and shall prohibit the grounding of such circuits when their voltage exceeds 150. This is followed by a quotation of the report of the electrical committee of the Underwriters' National Electrical Association, which rejected this recommendation on the grounds that, since the fire hazard must be as great from an undergrounded circuit in excess of 150 volts as from such a circuit carrying not over 150 volts, the Underwriters have no right to enforce a rule which they cannot defend on the ground that it lessens the fire hazard, but, on the other hand, that the Underwriters should use all of their moral influence in support of any rule which may tend to lessen the life hazard.

The committee expresses its belief that the grounding of secondaries is well recognized as the only effective means of preventing fatal accidents on defective secondary circuits, but that there are two matters of detail upon which great difference of opinion exists and upon which hinges the making of a safe rule because of easy compliance, or a dangerous one because of the impossibility of carrying out its provisions. These two matters relate, first, to the limiting voltage which should be grounded; and, second, as to how the connection with the ground should be made.

The committee adds that after three years' continuous study, and after having written and received hundreds of letters, and having been in conference with the leading engineers all over the country, it is unanimous in the opinion that secondary circuits up to 150 volts should be grounded, and above that voltage grounding should be prohibitive.

"Fatalities occurring with 150 volts, or under, have been so few that their occurrence may be actually ignored, while, on the other hand, at about 200 volts there are on record many instances where contact has resulted in a fatal accident. It follows, therefore, that to ground 150-volt circuits does not increase the danger, but, on the other hand, makes the handling of these circuits at all times safe. The grounding of 200-volt circuits does protect them against high-tension voltages due to breakdown of transformers and crosses with other circuits, which, however, are of infrequent occurrence, but, on the other hand, subjects the user to a constant risk of receiving a shock of 200 volts, or over, which experience has shown may be fatal. . . . It is, therefore, not only inadvisable to compel the grounding of 200 volts and upward, but almost criminal, for it would require one to do an act which might be the direct cause of an innocent user's death."

As to a suggestion that for 200 volts and upward grounding might be left optional, the committee believes this to be undesirable, for it evades the issue and puts the responsibility on the central-station man, who in some cases may not be able wisely to decide the safe policy. It considers that the grounding of 150-volt circuits will protect the lighting circuits in practically all of the cities of the United States, and knows of only three exceptions.

While recognizing the fact that 200/400-volt circuits for lighting mills, factories, parks, etc., are increasing, and that there are many thousands of motor installations using in excess of 200 volts which should be protected against high-tension voltages, the committee is also convinced that to ground these circuits presents a greater menace because it is always present, while the accidental cross or transformer breakdown is an unusual condition. It would gladly recommend a reliable method of protecting these circuits, but up to date no satisfactory scheme has been suggested. Thus far the only feasible method seems to be to install the apparatus in such a manner as to make it difficult for the user to stand on the earth or to be otherwise connected with the ground while touching lights or motors. This would mean installing lights so that they would be out of easy reach, controlling them with switches, and keeping them away from gas and water pipes, telephones, etc. It would also require motor equipments so placed that the attendant must stand on dry boards or rubber mats, and not be within reach of metal framework of buildings, metal floors, grounded pipe rails, etc.

In regard to the claim that electric lighting companies have failed to ground their circuits because of the cost, the committee believes this is not the reason, but rather that they are unable to secure grounds that are always reliable. The best ground, all admit, is a connection with an underground metallic water-pipe system. In many cities this exists, but its use is not always permitted, and in nine cities its use is prohibited. Members of this association should do missionary work in educating water-works engineers and managers and in proving to them that when secondary alternating-current wires are connected to water pipes no current flows unless a transformer breaks down or a cross occurs; that should such an accident occur it would, in nine cases out of ten, cause a fuse to blow and immediately cut off the current; and, further, that in the event of a current flowing it would be an alternating current which, it is generally believed, produces no electrolysis. In other words, the connecting of secondary alternating-current circuits to water mains places no additional burden upon the mains, but does render safe the use of such lighting circuits as are connected to them.

Where underground mains are not available other methods must be resorted to. The old method of a copper plate buried in coke, prescribed by the Underwriters, is not always reliable and in some cases has been found to be worse than useless. Iron pipes 1 in. or more in diameter, driven 8 ft. or 10 ft. into the ground have in some cases been found to be very satisfactory, while in other cases valueless.

A recent suggestion has been made to saturate the ground around the pipe at frequent intervals of time with salt water. Tests thus far made show that this is an excellent method and that after a few applications of the salt water the ground becomes permanently moist and a good conductor. The committee suggests the placing around the pipes, and rather near the surface, of a quantity of rock salt, which, because of its hygroscopic nature, will draw the water and thus produce a ground of low resistance and one that would also remain permanent. Users of this method are cautioned to take great care in making the connection between wire and pipe, as the presence of salt will tend to increase corrosion. The pipe itself will doubtless corrode, but a plain iron pipe will last perhaps 10 years, while one of galvanized iron will be good for several years longer. Brass pipe would last almost indefinitely and would not add materially to the total cost.

It is generally conceded that a solid connection with an underground water-piping system gives the best ground and that other methods suggested are, at best, substitutes. There are, however, places where for various reasons piping systems are not available. To meet these conditions other methods must be used. The committee does not feel sure as to the permanency of any of them, but thus far the tests indicate that under some conditions and in some soils they may be relied upon. Permanency of the ground is the great desideratum. It matters little whether the resistance is 5 ohms or one-fifth of an ohm, but if it is 5 ohms in winter and rises to 100 ohms in summer it can hardly be called reliable. The promiscuous grounding of ancient wiring installations regardless of their insulation resistance is not favored, but rather that these installations be brought up to standard requirements and then grounded, for by doing this not only is the life risk improved, but the fire risk as well.

The placing of several grounds on an interconnected secondary network has in some cases caused trouble when paralleled by poorly bonded railway-track circuits; in such cases the numerous grounds should be removed and one ground installed, or two grounds located near together, which should be of larger area, permanent and easy of inspection. As to those

who believe that some of their transformers are so weak that they would not stand a ground connection without breaking down, the answer is that they are culpably negligent and that such apparatus should come off of their circuits at once. Fortunately, there is little of this kind of apparatus in use, and few managers who would willingly put themselves in this class.

Protection from Lightning.

The report presented at Atlantic City by the N. E. L. A. committee on protection from lightning deals with the subject under the heads of distribution and transmission.

It is stated that the returns on distribution service indicate a high degree of successful protection. There have been some transformer and meter troubles, but these appear to be mostly on small-sized apparatus. The meter failures appear to be proportionately less on the large distribution systems with secondaries grounded. The number of arrester equipments for plants of this class is comparatively large; the failures of the lightning arresters reported, on the other hand, are comparatively small. There appears to be reasonable care in the installation and maintenance of grounds for lightning arresters, which are of both the buried-plate and driven-pipe types. There is as yet no uniformity in the spacing of outside lightning arresters. Only a few cases of station apparatus failures have been reported. Station apparatus is protected by lightning arresters of types similar to those used for lines and, in many cases, by choke coils, though the use of the latter is not universal.

As to transmission systems, the troubles reported have been confined almost entirely to the transmission lines themselves, failures of station apparatus being comparatively few. The line damage reported has been principally shattering and puncturing of insulators, splitting and burning of poles and cross-arms and in certain cases the burning off of line wires. The insulator troubles and burning of conductors have occurred on both steel-tower and wooden-pole construction. The experience of the last year, both in experiment and practice, indicates the shielding value of overhead grounded-wire protection. The reports show that choke coils have been generally used in connection with station protection.

The following recommendations form the remainder of the report:

DISTRIBUTING SYSTEMS.

Grounds.—Pipe grounds are recommended in preference to plate grounds as being simpler and more convenient to install and just as effective for the purpose for line work. For station protection, a number of scattered grounds offer the best protection; these grounds do not necessarily have to be of the plate form. Scattered pipe grounds may be utilized to accomplish the same result. Secondary distributing lines should be grounded in order to minimize the danger from lightning to apparatus on the customer's premises. The arresters should be so located that they will protect station and substation apparatus, underground cables and line transformers. More protection should be provided where the transformer capacity is greater, and especial attention should be given to any points that are particularly exposed, such as connections between overhead and underground lines, junction points, and the like.

Spacing.—In general, arresters should be spaced approximately 2000 ft. apart, and closer together at especially exposed points. The experience of some of the larger systems seems to indicate that the use of a greater number of lightning arresters than this involves an investment that is not justified by the measure of protection secured. In certain cases where a higher degree of protection has been attempted it has been found that the fixed charges on the added investment in lightning arresters have been greater than the losses in apparatus.

Records.—The committee calls attention to the importance of keeping a careful record of the losses of apparatus and interruptions to service each year as a means of determining whether the propert amount of protection has been provided. As an example, one of the larger companies finds, after several years' experience, during which careful records were kept of damage to transformers and lightning arresters, that the damage to line transformers was less than fixed charges on its lightning-arrester investment, and that the interruptions to the service caused by burning out of lightning arresters were much more serious and expensive than those due to damaged transformers. This company has decided, accordingly, to reduce the amount of protection on its distributing lines. This experience was gained on the basis of a spacing of arresters from 1000 ft. to 1500 ft. apart.

Inspection.—All arresters should be inspected frequently enough to insure their being kept in proper operating condition, and the occasional use of tell-tale papers in this connection is recommended as a check on their operation. This method often shows points that are insufficiently protected, as well as places where an unnecessary amount of protection has been provided. Where it has been found that the short-circuiting of an arrester has unduly disturbed the system or interrupted the service, fuses should be provided to cut out such arresters automatically.

TRANSMISSION SYSTEMS.

Stations.—General practice in station equipment shows the value of several types of lightning arresters working in multiple; for example, the multigap for ordinary disturbances and auxiliary horn equipments for surges. In certain cases the use of special arrangements of horn arresters has effectively passed off disturbances that otherwise would have been expected to seriously damage the standard protective apparatus. However, on account of the possibilities of this type of arrester thus setting up disturbances in the system, their general use cannot be recommended. The practice of installing choke-coils, which has been followed by most companies operating transmission lines, is to be commended, although conclusive proof of their usefulness is lacking. The multigap arrester has been giving good service, particularly on moderate voltages, but has its natural limitations. For instance, while it is sensitive and effective in taking care of momentary disturbances, it cannot be expected to discharge continuously for long periods as in the case of accidental ground on a normally ungrounded circuit. The recently developed aluminum cell type of electrolytic arrester, while not indestructible, has proved thus far to be capable of handling continuous discharges for much longer periods without damage. Although this type of arrester has not probably reached its final development, it is a definite improvement on the older forms of apparatus. In cases where the inherent limitations of the older types of arrester have proved them inadequate, the consideration of the aluminum cell-type arrester is recommended. In this connection, the aluminum cell-type arrester is particularly adapted for use on station buses.

Lines.—It has been found impracticable to attempt to protect transmission lines by the use of distributed arresters, on account of the intense concentration of lighting disturbances found to occur on such lines. It is evident that the cost of providing a sufficient number of arresters to properly protect the lines against such disturbances would be prohibitive, and the difficulties of proper inspection and care of arrester equipment would make it impossible. The most practicable method thus far found for protecting overhead lines from insulator failures and other damage due to the above causes has been by shielding them with grounded wires strung above them. A single steel cable strung well above the center of the operating lines, grounded at frequent intervals, has proved effective. Undoubtedly, ground wires on either side of the lines are an additional benefit, especially near stations, but the added expense of such construction must be considered in each case. On tower lines the overhead wire should be grounded at every tower, and on pole lines at least every 200 ft. or 300 ft. The pipe form of ground, above mentioned, is recommended. Some form of lightning rod should be extended several feet above the overhead ground wire at each of the points where it is grounded. Where overhead ground wire is not used, it has been found that even a small grounded conductor, running from a point near the top of the pole to the ground, tends to prevent splitting of poles.

ABSTRACTS OF N. E. L. A. CONVENTION PAPERS AND DISCUSSIONS

FOLLOWING will be found abstracts of 57 papers and reports presented at the Atlantic City convention of the National Electric Light Association. Where a paper or report was discussed, a resumé of the remarks follows the abstract. The order of presentation is not followed, the papers being grouped, so far as possible, by subjects. The running report of the proceedings of the convention, printed elsewhere, covers several subjects brought before the sessions which are not taken account of in this section.

Association Affairs.

PUBLIC POLICY.

The report of the committee on public policy, consisting of Messrs. Samuel Insull, chairman, Everett W. Burdett, Henry L. Doherty, Charles L. Edgar, George H. Harries, Joseph B. McCall, C. P. Steinmetz, Charles A. Stone and Arthur Williams, forms a volume of no less than 297 pages. The report proper of the committee consists, however, of only 11 pages, which is followed by the following papers and reports: "How the Pennsylvania Railroad Company Provides for the Welfare of Its Employees," by Mr. M. Riebenack, comptroller of the Pennsylvania Railroad Company, 18 pages; "Report on Profit Sharing and Mutuality," by Dr. W. H. Tolman, 38 pages; "Second Annual Report of the Philadelphia Electric Beneficial Association," 20 pages; "Rate Regulation," comprising the recent decisions of the United States Supreme Court in the cases of the Knoxville (Tenn.) Water Company and the Consolidated Gas Company of New York City, 30 pages; "Report of the Committee of the Chicago City Council on Local Transportation, and Ordinances of the Chicago City Railway Company and the Chicago Railways Company, passed by the City Council, Feb. 11, 1907," 175 pages.

The committee was gratified to report that the tendency toward municipal ownership has been lessened materially, although the movement is not dead. Whereas three years ago there was a tendency to rush headlong and thoughtlessly into this phase of socialism, without regard to cost or industrial or political effect, to-day any proposal for a municipal undertaking, if considered at all, would be received with little favor and subjected to the most careful investigation. This, in the opinion of the committee, was all that could be asked. The change in public opinion appears to be due to past and existing extravagance in municipal expenditure, to increasing reliance on public regulation and control and to more precise information about municipal undertakings in actual operation. The committee was of the opinion that the time will come when few municipally operated gas and electric plants will exist.

Public-service commissions direct the conduct of public-utility corporations in Massachusetts, New York and Wisconsin. Where the tendency is toward the creation of similar commissions in other States, the committee suggested that the attitude of the association should be favorable toward public supervision.

The street-railway settlement ordinances in Chicago, given in full in the appendix, were referred to as being novel and interesting.

The greater part of the report was devoted to an analysis of two decisions of the Supreme Court of the United States, rendered during the year, of such prime importance to the lighting interests of the country that they were given in full in the appendix. These are known as the Knoxville water case and the New York gas case. In the first, perhaps the most striking feature of the decision was the definite announcement that while "the courts, in clear cases, ought not to hesitate to arrest the operation of a confiscatory law . . . they ought to refrain from interfering in cases of any other kind." Another leading feature of the decision was that in cases where the companies refuse to accept a statutory or official rate without testing its constitutionality in court, the financial result of such rates, as applied to a single year's business, is not conclusive. The court held, in this case, that the results of the operation of the company in any particular year were only of significance so far as they foretold the future. The committee pointed out other important features of the decision, one being the grave doubt of the court whether a demonstrated reduction of income to 6 per cent, or 4 per cent after an allowance had been made for depreciation, would amount to confiscation.

In the New York gas case the court said that there is no particular rate of compensation which must in all cases and in all parts of the country be regarded as sufficient for capital invested in business enterprises. Among other things the amount of risk in the business should be considered. The less risk, the less right to any unusual returns upon the investments. In the particular case under advisement the court thought the Consolidated Gas Company of New York entitled to 6 per cent on the fair value of its property devoted to the public use. This is significant as establishing, in at least one case, a particular rate of return to which corporations of this character are entitled.

In the Knoxville case the court held that it is the privilege and duty of the company to allow for depreciation out of current earnings. Other important features of these decisions were pointed out by the committee. One is an emphatic statement in the Knoxville case indorsing the sanctity of private property. But, said the court, in the same case, the companies "will find it to their lasting interest to furnish freely the information upon which a just regulation can be based."

In view of these decisions the committee suggested:

(*a*) A full and fair appraisal of each company's property, tangible and intangible, employed in its business. If never used except within the company, it will be of value, while under certain circumstances it may prove invaluable.

(*b*) Careful attention to charges for depreciation, and an effort to write off neglected past depreciation as soon as practicable.

On the subject of old-age pensions the committee did not give an opinion, although it called attention to the subject, for in its judgment this country will soon be confronted with the question. The burdens of any such movement should be placed so that "our industries would not be unfairly handicapped."

Welfare work, especially as revealed in reports in the appendix, was spoken of as worthy of careful study.

STATE AND COMPANY SECTIONS.

Chairman R. M. Searle presented the report of the committee on State and company sections, which gives a resumé of what has been accomplished up to the present; advances arguments in favor of this branch of the association's work, and includes a draft of a constitution for affiliated State associations and for company sections, respectively. At present there are three geographical sections, namely, the New England, Pennsylvania and New Hampshire. Twenty-one company sections have been organized in the following cities: New York, Brooklyn, Philadelphia, Chicago, Boston, Detroit, Altoona, Pa., Bennington, Vt., Rochester, N. Y., Denver, Col., Washington, D. C., Newark, N. J., Dayton, Ohio, Connellsville, Pa., Des Moines, Ia., Salt Lake City, Utah, Chattanooga, Tenn., Scranton, Pa., Mount Vernon, N. Y., and Savannah, Ga. The total of members in the company sections is 1502, and the individual membership ranges from 2 to 465, the average being 71. The

number of meetings held up to April 1 varies from one to five, and the average attendance from 37 to 74 per cent. The Brooklyn, Denver, Chicago Commonwealth and Philadelphia sections print monthly bulletins.

As to geographic sections, it is stated that a State association on becoming affiliated with the national association may retain its own name, provided it is not inconsistent with its connection with the national association; but it recommended that in the use of such name some indication shall be given of the affiliation with the national body. There is nothing in such affiliation which shall prevent a State organization from electing its own officers, which officers may have as complete control over the State body as if it were not affiliated with the national body, except that the members of the State association, being also members of the association, cannot adopt any measures nor take any actions which are inconsistent with their individual membership in the National Electric Light Association. A State association, however, having members that are not private companies or are in no way interested in the production or sale of electrical energy for light and power purposes, or in the manufacture or sale of electrical supplies, cannot become affiliated with the national association as a State or geographical body, but an existing electrical section of such an association, or which may be organized for the purpose, may become so affiliated.

Discussion.

In presenting his report Mr. Searle said that the number of company sections brought down to date is 22; the number of geographic sections, 3; and the total number of individual members in the foregoing sections, 1843. The gain for the year resulting from the new movement was 136 per cent.

Mr. Chas. L. Edgar, of the Boston Edison Illuminating Company, felt that the State section organization should be pushed rather than the company section idea. His company had organized a section, but he thought perhaps this was a mistake, and that there was more benefit to the Boston men in meeting men from other companies than in meeting men in their own company. Mr. L. H. Conklin, president of the Pennsylvania Electrical Association, said that his association joined the N. E. L. A. at its last meeting. He thought the field for company and State sections was distinct. Local State conventions bring out discussions which the N. E. L. A. cannot bring out. Mr. H. W. Hillman, president of the Michigan Association, agreed with Mr. Edgar, of Boston, on the importance of first bringing the State association into the N. E. L. A. The membership of the Michigan Electrical Association was increased 125 per cent last year, mainly by individual memberships of company employees.

Mr. S. Fred Smith, president of the former Association of Electric Lighting Engineers of New England, which has become a section of the N. E. L. A., explained that the association had consisted of individuals and that it was merely necessary for these to transfer their membership to the N. E. L. A. He thought it frequently desirable to have municipal-plant managers in an association because they could recommend legislation which a company could not. Mr. Dudley Farrand said that the Public Service Corporation of New Jersey had organized a section, although previously there were several organizations within the company for various similar purposes of mutual benefit and discussion. He thought that possibly all these organizations would in future be merged into the company section of the N. E. L. A. Mr. D. B. Rushmore, of the General Electric Company, called attention to overlapping of effort on the part of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the N. E. L. A. on certain engineering matters. He favored a combined effort of these organizations in relation to purely engineering matters.

Mr. C. N. Stannard, on behalf of the Denver Gas and Electric section, reviewed some of the advantages of the meetings conducted by this section, the meetings of which are bringing about an exchange of views between the commercial and the technical men in the company, which was very desirable. Mr. M. S. Seelman said that in Brooklyn, where the company had 1600 employees, it was impossible for the higher officers to keep in close touch with all their employees. The organization of an N. E. L. A. section, and the holding of meetings have given an opportunity for bringing out and recognition of unsuspected talent among certain employees. Mr. D. W. Mendenhall, of Salt Lake City, said that his company had barely enough men to form a section, but had done so and thought that it would be successful. He urged other companies in the inter-mountain district to organize similar company sections as a foundation for an inter-mountain section of the national association.

Mr. H. Almert told of a club which he organized in a company to study the science of industrial success. This had brought out some unsuspected talent and was so successful that other concerns in the same city had formed similar clubs. General commercial topics were taken up at weekly meetings and technical subjects at a monthly meeting. Mr. H. Goodwin, of Philadelphia, called attention to the fact that the men lower down in a company do not have an opportunity to get much benefit from a State organization, but get considerable benefit from a company organization or section. Mr. R. M. Searle, of Rochester, emphasized the point that a company section offers an opportunity to train a given lot of men to a given policy, so that all the employees of the company will understand the policy of its management, and will explain it properly when coming in contact with the public. Sometimes even the employees of a company do not understand its policy; consequently they cannot talk it to the public, and there is no uniformity in the expression of its employees to the public. But few men can attend State or national conventions.

Mr. E. F. McCabe, of Lewistown, Pa., told of some of the difficulties encountered in making the Pennsylvania Electric Association a section of the N. E. L. A. Some companies are members of the N. E. L. A., and some are not. There is apparently no way of making these latter companies join. Mr. John F. Gilchrist said that officers of State associations were likely to shy at the proposition of merging with the N. E. L. A. As regards company sections, he thought that some companies having but few employees might not need an organization of this kind. In most large companies there is a need for some organization which will bring the men together occasionally, and N. E. L. A. company sections form a good basis upon which to accomplish this result.

QUESTION BOX.

In a paper on this subject Mr. Alex. J. Campbell considers the present and future status of the Question Box. He believes that it should be made most useful to members in comparatively small companies, as in large companies there are always specialists in each line, and occasionally company associations which conduct a question box of their own. As to obtaining answers to queries, the present plan is to distribute queries widely among the members, and an endeavor made to secure at least one answer from each member. There is now under way a revised question box which will cover current issues and all previous issues, and will be something in the nature of a hand-book. The author and Mr. Paul Lupke will be editors of the revised edition, but the work of revising all past material will be handled by a large number of co-editors, each an authority on a particular subject. The plan is to collate the material and information in all of the past issues of the Question Box, condense this and put it in such form as to be readily available for reference. It has been decided to adopt the form of a loose leaf book, each page being properly indexed and numbered. There will be a permanent revision committee, to which material in current issues of the Question Box will be referred as it appears, and this new material will be incorporated with the revision. From time to time pages in the hand-book containing obsolete material can be withdrawn and new sheets substituted, thus enabling the hand-book to be kept alive and up to date.

Power House Design and Operation.

FUTURE REQUIREMENTS OF CENTRAL-STATION COMPANIES.

Assuming that the types of apparatus will depend mainly upon the development of central-station practice in generating, distributing and commercial applications of electricity, Mr. Philip Torchio, New York, in his paper with the above title, makes a forecast of the technical trend of the industry during the next 10 years. He gives the conservative figure of 6,000,000,000 kw-hours as the total yearly output of the central stations in this country and estimates that the average load-factor is approximately 23 per cent. Future additions should be undertaken with a view to securing the greatest economy under poor load factors and heavy peaks of short duration. Fifty per cent of the generating apparatus should have the greatest possible efficiency regardless of cost, and the other 50 per cent should be of the cheapest kind regardless of operating efficiency. The guiding rule in the operation of combination systems should be that the longer the efficient operates and the inefficient is shut down, the greater will be the commercial returns.

In the generating equipment, Mr. Torchio says the steam turbine may be built in larger sizes than present 15,000 kw-units; but there is little to be gained in this direction. The present frequencies and voltages will persist; and direct-current turbo-units as small as 2000 kw are not improbable. Desirable improvement on existing turbo-generators are greater mechanical strength and rigidity of winding and supports, and means for promptly extinguishing fire on short-circuited generators. Forced ventilation on windings will play a great part, recourse being made to the same expedients adopted in the early "Jumbo" dynamos. Low-pressure turbines and gas engines will increase, and the elimination in the central station of lead-covered cables and iron conduit, the introduction of reactances in generator circuits and the development of a satisfactory overload relay for generators, will make multiple operation of generators entirely safe.

There will be little change in substation apparatus. Rotaries with a maximum output of 3750 kw will probably not be surpassed in size; but storage batteries giving from two to three times the output of the usual standard type of battery, occupying the same floor space and at a cost per kilowatt at high rate of discharge approximating one-half the cost of the former standard batteries, have already made their appearance. Underground distribution is standardized and will not change. With a cheap, reliable and not unsightly exposed system of wiring, cut-outs, etc., older buildings can be connected up with profit to both the central station and the consumer. Electrical refrigeration will replace the ice man, and artificial ice manufacturers should logically depend for power upon the central-station companies. A differential rate meter will make practicable the use of electricity for heating where lighting rates are now prohibitive, and improvements should be expected in electrical vehicles. The electrical industry will require professional, operating and business men of broad knowledge, sound views and superior ability.

Discussion.

Mr. Samuel Insull, Chicago, said that it would seem unnecessary for a large city to suffer from a poor load factor. If a greater diversity of business could be secured in New York it would seem that the load factor ought to exceed 30 per cent. In answer Mr. Torchio said that the average load factor of all the lighting plants of the United States a few years ago was 23 per cent, the load factor of the railway companies in the country being an average of 30 per cent. It is doubtful if the load factor under present conditions in New York can be made to exceed 35 per cent. Mr. Insull said that by combining the railway and lighting load in Chicago, the load factor had been raised to 40 per cent. The load factor here was defined as the average load divided by the maximum load, the latter being represented by the total output at normal rating in a year of 8760 hours.

SOME UNIQUE FEATURES OF POWER-HOUSE DESIGN.

The purpose of Mr. G. L. Knight's paper on this subject is to call attention to some of the features of recent central-station design that have been departures from general practice and which have been adopted because of economy, safety or convenience. The author, who is connected with the Brooklyn Edison Company, has unfortunately limited his observations and descriptions to large stations, so that the paper, although replete with interesting information, possesses very little that is at all applicable to the smaller stations. The paper is not burdened with details, but merely relates how a certain company, for instance, secured increased furnace economy with stokers by lengthening the arch over the stoker a certain amount. The information for the most part is indicative, with hints as to application in a general way, the actual working out being left to the reader who desires to apply them. In the boiler-room the following departures from ordinary practice are described: Deep grates for anthracite coal; ash and soot hoppers as part of concrete foundation for boiler setting; pneumatic ash ejector; spring joint for use on superheated steam lines; concrete air chamber under center aisle of boiler-room; blower engine regulated by pressure in air duct; centrifugal boiler feed pumps; application of Venturi meters for measuring water and steam; coal distributor for narrow aisles; searchlights on coal towers for night operation. The topics covered treating on other parts of the system are: Three condensers for two turbines; dry-tube condensers; turbine-driven circulating pump; auxiliary step-bearing pressure accumulators; elecrete, a cement for barriers; fireproof protection for cables not run in conduit; lock-bolt disconnective switch; auxiliary switch on oil switches to act as tell-tale in case switch falls in by gravity; use of wire of various colors for control wiring; improved method of bringing out armature leads; armature leads insulated with rubber and varnished cambric; 135,000 kw automatically synchronized; device for indicating speed of incoming induction motor-generators; transformer ground detector; selective ground indicators; printing attachment for indicating wattmeters; pop valve for bellows-type time-limit relay; test adapters for use in calibrating and checking station instruments; signaling systems; system for indicating to boiler-room conditions of load; signals to boiler-room indicating change of load; signaling system between high-tension switchboard and operating room; signaling system between operating room and turbine room; emergency system for signaling substations; transfer bus for two-phase circuits; design of direct-current switchboards; combined operator's desk and pressure wire switch; brushes for vertical rotaries; and automatic control of water to water-cooled transformers. Much of the work embraced in the foregoing titles is, of course, special and would probably only be applicable in a very limited number of stations.

CENTRAL STATIONS IN TOWNS OF LESS THAN 4000 INHABITANTS.

Mr. James S. Knowlson, of Schenectady, prefaces his paper with the above title with the statement that while the number of electric light stations in towns of less than 4000 inhabitants comprise 65 per cent of the total number of stations in the country, they receive but scant attention from the engineering fraternity. The problems which they must solve in order to prove a financial success are not discussed with anywhere near the same fulness of details as those of the large stations, and while some engineers have doubts as to whether such stations are operated properly, very many of them are making as large returns on the investment as more pretentious stations. The author voices the need of co-operation among small station managers for a broader and more analytical discussion of their problems; he outlines the factors that must be given weight in the design of such stations, touches on those policies that have helped to make some of them good financial propositions and suggests a few methods of increasing business. Small central stations are essentially local institutions, and to be effective Mr. Knowlson suggests there should be a wide distribution of stock in the community, with the best business men of the town as executive officers. Such a company will receive the hearty

co-operation of the people as a whole, and the attention which the best business men can give it.

On the subject of location and equipment the author gives some thought, restricting his remarks to stations using steam boilers and engines. He advises locating the station near the railroad and in close proximity to good water supply, and that sufficient ground be obtained to provide space for storage and stables. If the location is also reasonably close to the center of distribution, it may be declared to be ideal; but the last consideration is not as important as the other two. The power-house arrangement should combine simplicity, convenience for operating purposes and susceptibility to economic extension, not to mention reasonable compactness. An ideal layout for a 100-kw station is given, parallel engine- and boiler-rooms prevailing, and simple, non-condensing, high-speed engines belted to 50-kw generators being installed. In such a station, says the author, the engineer will have as fireman a rather unreliable helper, and at times he will probably act as fireman himself. With the arrangement mentioned, the engineer may stand in front of the switchboard and from that position be in full view of the gages on the end of the boiler, and from the boiler-room he may still be in full view of the switchboard. Twelve short steps will bring him from the firing floor to the engine-room. The station is provided with many windows; ample space is allowed on all sides of the generating apparatus; the steam piping is of the most economical length and interconnected, permitting utmost flexibility, and the auxiliary apparatus, heater and boiler-feed pump are conveniently located. In the boiler-room sufficient space is allowed for cleaning boilers and storing coal. The fuel is unloaded from cars into a bin at the end of the boiler-room and is fed automatically to the firing floor through an opening in the base of the building or may be wheeled in through the doors at either end, which also permits a ready exit for ashes. With such an arrangement the natural extension of the plant will cause the boiler and engine-room to grow side by side. In small stations tubular boilers are generally installed; for while water-tube boilers are capable of better economies, the efficiency of the boiler plant rests heavily upon the methods of firing and the higher first cost of water-tube boilers seldom pays for their use in small stations. Diagrams show the average first cost of horizontal tubular boilers, including setting, the first cost of brick and sheet-iron stacks, cost of high-speed engines and direct-connected and belt-connected generators. In small stations it seldom pays to operate condensing, but the decision will rest upon the capacity of the station, nature of the load, price of fuel, availability of water, etc.

High-speed engines or turbines are the only prime movers to be considered, and while from an engineering viewpoint direct-connected units are preferable, space is plentiful and belt troubles so small that belted sets may be best because of the lower first cost. The generators should be 60-cycle polyphase machines, the voltage depending on the distribution circuits. If the load is in the immediate vicinity of the station, a 220-volt, three-wire system with step-up transformers for outlying districts is the most economical. The switchboard should be of the simplest type. Outside the station the largest single item of first cost is the pole line. A curve shows the approximate cost of poles in six different localities; 30-ft. or even 25-ft. poles will suffice. In arranging the secondary distribution every attempt should be made to install transformers in as large units as possible. The saving per kilowatt in price, core and copper losses which may be effected by using a single unit in place of several small ones, is shown by a curve. A combination of arcs with a relatively large number of incandescent lamps will provide the most satisfactory street illumination in the average small town, and the author gives a table showing the first cost and operating expense of magnetite-arc lamps and series-tungsten lamps in various sizes. The table also shows the number of incandescent lamps necessary to provide the same street illumination as one arc lamp. Under the caption of economies and improvements in operating conditions, the author lays stress on the need of simple but adequate records, and on the necessity for inspection and repair of apparatus. Other features leading to economy are also touched upon.

Mr. Knowlson gives some shrewd advice on business getting, having in view a 24-hour service. He points out that it is possible to broaden the scope of the small central station by combining with it the sale of water, ice and heat. These do not add materially to the investment or labor costs if the plant operates 24 hours a day, and a table giving the gross revenue per capita in a number of typical central stations ranging from purely lighting stations to those furnishing water and ice also shows that they are prosperous.

Apparatus, Electrical and Steam.

PERFORMANCE SPECIFICATIONS AND RATINGS.

Mr. W. L. Waters, of the Westinghouse Electric & Manufacturing Company, in a paper entitled "Performance Specifications and Ratings," made several recommendations having in view an improvement in what is stated to be the present very unsatisfactory condition concerning the rating of generators and motors. After criticising the present system of temperature guarantees, it is stated that the most rational method of temperature rating is to specify the maximum continuous rating at which a unit can be safely operated with a certain room temperature—25 deg. C., for example; and where desirable, a safe two-hour or three-hour overload, with the same room temperature, can also be given. This reduces the system to a single guarantee of the maximum safe load which a unit will carry continuously with a specified room temperature; and this maximum load will be the greater the lower the temperature of the air which cools the machine. Referring to the influence of the power factor on the rating of a machine, it is stated that any method giving alternators a different rating for every operating power factor would probably be too complicated for practical work. A method, however, is quoted with approval whereby all machines shall be given a nominal rating in kilovolt-amperes at 100 per cent power factor, and in addition the maximum load given which they will carry at various lower operating power factors. The maximum load at low power factors is decided for some machines by holding up the voltage, and for others by the heating of the field coils. In the latter case this maximum load should be referred to a definite room temperature—25 deg. C., for example. This method gives for the purpose of comparison a nominal rating at 100 per cent power factor, and in addition gives the purchaser exact information as to the operative characteristics of the proposed unit under any particular condition of load.

As to rotary converters and synchronous motors, the power factor with these should be kept strictly at 100 per cent, unless for some special reason definitely specified and understood at the time a machine is purchased. If synchronous motors are used to correct the power factor of a line, the maximum kilovolt-amperes at the required power factor should be specified, exactly as in the case of the alternating-current generator. A synchronous motor designed to operate at 100 per cent power factor is just as unsuitable for operating at a low power factor as an alternator would be in a similar case.

Testing to determine if a unit meets specified detailed performance guarantees is always a very difficult question. Unless the test is made in the laboratory the input-output efficiency test of, say, a motor-generator cannot be made with greater accuracy than 2 or 3 per cent, and it is almost impossible to get an accurate direct test of the voltage regulation of an alternator. In both these cases the direct method of test has to be abandoned in favor of an indirect method, which will give more accurate results. Temperature tests are extremely difficult to carry out accurately, and unless careful precautions are taken by experienced observers it is often impossible to be sure of results to 5 deg. It is concluded that in general a customer will do better to spend his time in investigating the conditions of operation and specifying a machine suitable for these conditions

than make tests to determine regulation and temperature rise. By means of suitable performance specifications, which can be definitely checked in operation, a customer can hold the manufacturer.

Discussion.

Mr. Philip Torchio said that rating based on 100 per cent power factor was useless for ordinary practical conditions, probably 10 per cent of the generator capacity of the country has been wasted because of specifications drawn this way and the inability of generators to carry the load which their prime movers would enable them to carry. A 90 per cent power factor for 60-cycle apparatus, he thought, would be a better basis of rating.

Mr. Walters thought that 70 per cent power factor would be nearer correct for 60-cycle apparatus.

EFFICIENCY OF MOTOR GENERATORS AND SYNCHRONOUS CONVERTERS.

Converting apparatus at present employed in this country comprises motor-generators without step-down transformers and synchronous converters with step-down transformers. There are two standard types of motor generators and three of synchronous converters, and since all are generally applicable for the same class of service, the question naturally arises as to which is the best to install. Mr. F. M. Farmer, of the Electrical Testing Laboratories, in a paper essays the task of settling some of these questions from a series of tests made on 60-cycle motor generators and 25-cycle synchronous converters under normal commercial conditions. While the primary object of his paper is to present the results of these tests, the subject is of such importance and general interest that a brief discussion of the merits and demerits of the different types from standpoints other than that of efficiency is included. Before taking up the tests, the author outlines the principle of each of the five types of converting apparatus, namely: generator with induction motor and without step-down transformers; generator with synchronous motor and without step-down transformers; synchronous converter with induction regulator and step-down transformers; synchronous converter with synchronous booster and step-down transformers, and split-pole synchronous converter with step-down transformers. It is now generally conceded that 25-cycle converters are entirely satisfactory and that the use of 60-cycle converters is practically restricted to railway loads, since, as a rule, it has not been found possible to obtain satisfactory operation on the lower voltage required for lighting and power work. Motor-generator sets, on the other hand, operate equally well on both 25 cycles and 60 cycles and with practically the same efficiency. Synchronous converters operating on 25 cycles and motor generators operating on 60 cycles may very properly be compared since each would then be operating under normal and favorable conditions.

Unfortunately, the character of this excellent paper is such as not to admit readily of abstract. The results of the tests are all tabulated or plotted in curves and logical deductions drawn from them. The paper embodies probably the first disinterested comparison between apparatus made by rival companies and the general conclusions are interesting. Whether to use motor generators or synchronous converters for lighting and power work depends to a great extent on the circumstances in each individual case. The data given in the paper are held not to justify the use of motor generators except possibly on 60 cycles or where the alternating supply fluctuates badly. The principal advantage of the motor generator is its flexibility and the entire independence of the direct-current system from the alternating-current system. If the high-tension alternating-current supply is reasonably free from fluctuations, these advantages are of no value and are more than counterbalanced by lower efficiency and increased first cost. Comparisons of the various types of synchronous converters are at present in favor of the synchronous booster converter, but the split-pole machine is so recent a development that improvements in design, which will undoubtedly be made, may improve the efficiency curve and the operation of the machine to such an extent that this conclusion may be reversed. A table shows the kilowatt rating of motor generators and synchronous converters that each of eight large companies had installed on the first of the year. Only apparatus used for lighting and power has been included. The total kilowatt rating is 309,970, apportioned in percentages as follows:

		Per cent.
Motor generators	Induction motors	8.3
	Synchronous motors	21.4
Synchronous converters	Induction regulators	64.8
	Split-pole	1.6
	Synchronous booster	3.9

It should be remembered in connection with these figures that the split-pole and synchronous-booster types of converters have been developed only about two years, while induction regulator equipments have been in use for perhaps 15 years and motor-generators still longer.

Discussion.

Mr. W. L. Waters, Pittsburgh, commented upon the unfavorable operation of the split-pole rotary and noted that the paper of Mr. Farmer condemns it on the grounds of efficiency, synchronizing, power factor, hunting, range of voltage and the necessity of reserve current circuit-breakers. It is more accessible for repairs and cleaning than the synchronous booster, but this is a small advantage. It is doubtful if genuine sine waves can be obtained from the split-pole rotary. Mr. L. L. Elden, Boston, dissented from Mr. Farmer's conclusions as to the superiority of the rotary compared with the motor generator. First cost and efficiency are not the whole story. It is dangerous to make sweeping statements based on tests upon one machine of the class. The results in all-day service largely depend on the machine's load factors. The set tested by Mr. Farmer had an excess voltage of 5 per cent, and the manufacturer's guarantees were not attained. Mr. Elden cited the following results of efficiency determinations in certain substations of the Boston Edison system:

Equipment.	Kw-hours per year.	Yearly efficiency.
Two 1000-kw sets	6,500,000	82.73 per cent
Two 500-kw sets	.....	83.67 per cent
One 1000-kw set	.....	
Two 500-kw sets	4,000,000	84.93 per cent
One 1000-kw set		
Three 500-kw sets	3,000,000	83.48 per cent
Five 500-kw sets	4,000,000	83.59 per cent

The efficiency of the complete systems is 82.45 per cent.

The actual difference in efficiency between motor generators and rotaries installed under comparable conditions may be about 3 per cent. Assuming a difference of 5 per cent, this would mean at a generating cost of 0.5 cent per kw-hour only $10,000 saving per year, which is not a large sum to pay for the insurance against trouble which motor-generator equipment furnishes. Mr. P. Torchio, New York, then described the raising of the efficiency of the New York Edison system from 89 to 91 per cent in the past three years by the use of synchronous apparatus. Mr. J. L. Burnham, Schenectady, pointed out the importance of knowing the condition of the commutator, brush friction, bearing friction and windage in studying these machines. Differences in the station wiring and in the air-gap adjustment are significant. Mr. C. W. Stone, Schenectady, urged the necessity of comparing machines on the same basis, and cited the successful service of inverted split-pole rotaries at Gary, Ind. In conclusion, Mr. Farmer said that the tests had to be made under service conditions; that they checked with figures obtained locally, and that the data were taken between the high-tension and the low-tension busbar.

SOME RECENT DEVELOPMENTS IN ELECTRICAL APPARATUS.

That recent improvements in the manufacture of generating, converting and transforming apparatus have been attended by better methods of cooling and higher speeds for rotating machinery is the conclusion of Mr. E. W. Allen, of the General Electric Company, who is the author of the paper with the above caption. Mr. Allen describes a 14,000-kw, vertical-shaft turbo-alternator, the novelty of which is the high speed of rotation which has resulted in the production of a generator of small diameter, large output per pound of materials and smaller radiating surface, but without commensurate decrease in cost. In order to conduct the heat away the generator is enclosed except at the intake and discharge openings. When the machine

is running the revolving field acts as a powerful fan, and while the scheme is applicable to large generators, it does not apply to all sizes. Direct-current generators for high-speed work now have their commutator bars held in place by steel rings shrunk over the outer circumference of the commutator, thus affording great mechanical strength and ready insulation of the bars due to their plane shape. The difficulties encountered in the high frequency of commutation have been overcome by the adoption of auxiliary commutating poles. In the design of belt-driven generators many changes have taken place. As a result, it is possible by a change in the field coils to convert a direct-current generator into a constant or variable-speed motor suitable for machine-tool work. Full advantage is taken in the design of the benefits to be derived from the use of commutating poles and particular attention has been given to the ventilation and to assisting the movements of air through the field and commutator coils by means of a fan mounted at the end of the shaft opposite the commutator. In the converting apparatus the author describes the regulating-pole, synchronous converter and its operation. Vertical-shaft synchronous converters rated at 2500 kw are being built for locations where space is limited. No change has been made in the general design of frequency changers except that vertical-shaft construction is used here also. A 6666-kilovolt-amp, 0.75 power-factor, 25-cycle to 60-cycle set is now being built for the Commonwealth Edison Company, which in point of output will be the largest yet built. The author notes the improvement made in the methods of circulating the oil in transformers, and in this way providing a more efficient means of conducting the heat from the seat of its generation. Controlling and protecting apparatus have improved somewhat in design and contributed in a large degree to the progress that has attended the electrical industry. The aluminum-cell lightning arrester has increased in reliability on high-voltage transmission lines and may be termed one of the most important developments that has taken place in the design of protecting apparatus. The author records the commercial status and success which have attended its operation and which have caused the manufacturer to adopt and recommend it as a standard device for all classes of high-tension transmission lines.

STORAGE-BATTERY DEVELOPMENT.

Mr. Joseph Appleton, of the Electric Storage Battery Company, in a paper entitled "Advanced Information Regarding Development in Storage Batteries" dealt, among other things, with a new system of central-station storage-battery emergency service and the use of storage batteries for exciting service and for power service. In systems such as the New York Edison system, generating current at one or more stations, and distributing over wide areas, there are chances of interruption to service, usually of short duration. To provide for such emergencies a storage battery has been designed to give the maximum output of energy for short and infrequent periods with a minimum first cost, low up keep and minimum space required. Such a battery installed in one of the New York Edison substations gives nearly twice the output of the old type of battery for double the time and with a higher terminal voltage. For the same space occupied, and with only 15 per cent increase in weight, the output of the new plate will vary from two to four times that of the old plate, according to the rate of discharge taken as a basis of comparison. Batteries of this kind used for emergency service are not called upon to discharge as many kw-hours per annum as in the former service, which makes a material difference in the cost of maintenance and in battery space occupied and means a saving both in real estate and cost of building.

Special auxiliary apparatus for this emergency service has also been designed. The end-cell switches travel at a high speed and are capable of carrying for short periods currents up to 20,000 amp. The switches can cut in or out one to three cells per point while carrying the maximum current, a voltage change of three cells per point being considered satisfactory for this kind of service. In the usual three-wire battery plant it is customary to have 20- or 25-point end-cell switches on each side of the system, cutting in 19 or 24 end cells, respectively. With the new type of switch 19 end cells are cut in or out with 12 points instead of 20, and yet giving one cell per point regulation for seven cells around the floating point. A method of applying the storage battery as a stand-by in connection with the exciting system of large alternators is described. The former objections to this application have been overcome by connecting the battery across the bus through a suitable resistance, which reduces the fluctuation in battery current to a negligible amount, with normal fluctuations in exciter bus voltage. In case of abnormal fluctuations, a switch is automatically closed which short-circuits the resistance, leaving the battery free to operate on the bus. Immediately after the switch is closed the exciters are automatically disconnected from the bus, and the batteries furnish all current to the bus until the cause of excessive variation has been removed and the exciter is again returned to service. For special cases a booster may be used with this arrangement to govern the charge and discharge rate, but as it would be out of service during the emergency discharge it can ordinarily be a very small machine.

As to the use of storage batteries in connection with central-station power contracts, two principal cases are mentioned—where the power demand is subject to frequent fluctuations and where there are peak loads of short duration. The installation of the storage battery in such cases will often turn a customer with a poor load factor into one with good load factor, and the method can be applied to both direct-current and alternating-current supply. Attention is called to the regulating features of the storage battery in connection with fluctuating direct-current and alternating-current loads, and with particular reference to the electrification of steam roads, and the increased use of electrical energy in manufacturing plants where large motors on fluctuating service are used. As an example of the latter, the storage-battery equipment of the Gary steel plant is referred to. This consists of two batteries of 125 cells each connected in parallel, and capable of discharging on regulating service at 17,280 amp, while the ultimate capacity of the battery equipment will be double this. As an illustration of the character of the load to be regulated, the rail mill alone requires to operate it three 6000-hp and three 2000-hp induction motors, besides auxiliaries, a total of about 25,000 hp. The load is subject to wide fluctuations, which are cared for by the storage battery. Rotary converters are used to convert the battery current into alternating current for the regulation of these fluctuations and enable a constant voltage to be maintained on the alternating-current end of the rotaries, while the direct-current end, which is connected directly across the 250-volt battery, has a varying voltage as required to enable the battery to attain its maximum rate of discharge or charge as the condition of the load demands. The advantages of the storage battery in connection with the operation of gas-engine-driven alternators in parallel are pointed out, and reference is made to the ideal means of charging storage batteries by the use of mercury-arc rectifiers.

GAS ENGINE REPORT.

The report of the committee on gas engines, consisting of Messrs. John B. Klumpp, chairman; Carleton A. Graves and Irving E. Moultrop, comprises 114 pages and 37 illustrations. The principal divisions of the report are under the heads of gas producers, their theory and operation; gas engines; heat diagrams; gases; calorimetry; plants visited; suggested producer lay-outs; representative installations; miscellaneous data; descriptions of gas producers; tests of gas producer and engine installations.

The committee reports considerable progress in the gas producer and states that there are now on the market producers that can gasify successfully fuels which cannot be burned economically under boilers. Referring to the operation of the modern gas engine, it is stated that its reliability cannot be questioned at this time, and that the committee has evidence of many plants, some of which were visited by its members, that have been operating over long periods without being shut down —even a month without intermission. Regulation has been so perfected by improved designs and methods of governing that

all reliable makers to-day will undertake contracts for installing gas engines of either the two-cycle or four-cycle type to operate in parallel alternating-current generators of 25 cycles or 60 cycles; and the committee adds that no member need hesitate to contract with any of such concerns on the score of reliability and regulation, as just as reliable results may be obtained as with the ordinary type of steam engine. As to the operation of gas producers, the personal equation enters largely and poor results are frequently the result of careless operation. Instructions for operation should be followed carefully, and a man of intelligence placed in charge of a producer installation. The report gives descriptions in greater or less detail of about a dozen plants visited.

The cost of these plants, including buildings, foundations and cost of erection, varied from $133 to $167 per maximum kilowatt capacity, the average figure being $152; the maximum capacity being about 20 per cent above the normal rating. The cost of the buildings varied from $16 to $44 per kilowatt, with an average of $33; of producer equipments, including piping, from $33 to $49 per kilowatt, with an average of $38; of the gas engines, from $38 to $55, with an average of $47; foundations, $5 per kilowatt; generators, $12 to $15, and switchboards, $3 per kilowatt. The maximum capacity of the plants ranged from 360 kw to 2700 kw, with an average of 1200 kw. Tests of short duration indicated a coal consumption as low as 1 lb. per hp-hour, which figure, it is stated, can be also obtained from units as low as 100 hp or even less.

Discussion.

The chairman opened the discussion by complimenting the committee on its very comprehensive and excellent report. Mr. M. R. Bump, of New York, emphasized the value of the report to central stations competing with natural-gas or producer-gas generated from low-grade fuel. The Western Chemical Company, of Denver, has a gas-engine plant in which Colorado lignite coal is used successfully. This is one of the poorest fuels to be found in this country. This company removes the carbon dioxide from the waste gases of the engine and uses it in the manufacture of carbonic acid gas for soda-fountain service. Mr. George R. Stetson, of New Bedford, Mass., then said that his company recently came into possession of a 500-hp gas engine which had been improperly applied to the local conditions surrounding its installation. An attempt had been made to use the engine on fuel derived from a peat bog, and the foundations were very poorly erected. The New Bedford Gas & Electric Company purchased this machine and installed a pressure-type producer. Experience has shown that if the engine can be supplied with the right kind of gas it will do proper, consecutive and regular work. The producer is the seat of most of the trouble. It is a difficult task to man the pressure producer, and the company has had from 20 to 30 men at work there during the past year. The cases are sometimes quite offensive. It is necessary to keep two sets of employees as the boiler tnders are of no use in the producer plant. Mr. E. F. McCabe, of Lewistown, Pa., said that he is in charge of a central station which will shortly be transformed into a hydro-electric substation. His company generates water-gas for local service at a manufacturing cost of 40 cents per 1000 cu. ft., and he is contemplating the installation of a 1000-hp gas engine as a stand-by. Mr. Moultrop closed the discussion by stating that the Denver plant is apparently very successful. The committee report discusses the cost of gas-engine plants on the basis of the maximum output of the station including buildings, foundations and apparatus. These investment costs run from $133 to $166 per kilowatt. There is a prospect of the gas-power installation's space requirements being cut down to the limits of modern steam-plant practice, and with this a reduction in initial cost is expected, so that the two types of station will be comparable in their investments. It is very important that the small stations shall be assisted in the measurement of their output by the larger company. A notible case of the successful use of the gas engine as a stand-by in connection with a hydro-electric transmission system is that of the Georgia Railway & Electric Company, in Atlanta, where a 2000-kw gas engine is operated on city gas furnished by the company itself. This machine can be started cold and synchronized in less than one minute.

LOW-PRESSURE STEAM TURBINES.

Mr. C. H. Smoot, New York, in the above paper sets forth arguments in favor of the use of low-pressure turbines of the Rateau-Smoot type. This type is described in detail, and the advantages claimed for it are brought out by comparison with other types of similar turbines. The author states that it has now been thoroughly established that the most efficient steam engine is a compound unit, consisting of a reciprocating engine acting between boiler pressure and approximately atmospheric pressure and exhausting into a low-pressure turbine, which in turn discharges into a condenser. While it is still a mooted question whether the greater cost of a combined engine and low-pressure turbine plant over that of a turbine plant alone will compensate for the increased economy, there is no doubt that existing plants equipped with reciprocating engines will show an improved economy if run non-condensing in connection with a low-pressure turbine equipment. In conclusion the author strongly recommends that owners of non-condensing plants should consider the opportunity of utilizing the exhaust steam of reciprocating engines in low-pressure steam turbines.

Discussion.

Mr. A. R. Cheyney, Philadelphia, moved that a committee be appointed to consider the subject of lower-pressure turbines, condensers and cooling towers. The motion was carried and will go before the executive committee of the incoming administration. Mr. C. B. Burleigh, Boston, said that reliability is more important than high efficiency in steam-turbine operation. The success of the step-bearing in the vertical type of machine has been thoroughly demonstrated. Mr. Dreyfus, Pittsburgh, stated that the low-pressure turbine is valuable to increase both efficiency and capacity, minimizing investment cost. He figured an improvement in economy of from 20 to 50 per cent in the application of the low-pressure turbine to 1000-hp unit, with an increase in capacity of from 33 to 80 per cent for the same steam evaporation. A safe clearance is feasible with reduced economy. The regenerative system will hardly be required in central-station service.

In conclusion, Mr. Smoot stated that the low-pressure turbine of the Vandergrift installation, Pittsburgh, has been tested and shows about 28 in. vacuum, 13.7 lb. absolute admission, steam consumption, 38.3 lb. per kw-hour, when running at 700 kw. Its capacity is 800 kw. The steam efficiency of the conversion of heat into electric power is 57.3 per cent. The largest turbine at present operating in this country has 28 times the capacity of the Vandergrift machine, showing an efficiency of 59.5 per cent when compared on the same basis.

CONDENSER AND COOLING-TOWER DESIGN AND OPERATION.

Mr. M. R. Bump, New York, treating certain points in the design and operation of condensers and cooling towers, shows that the cost of pumping the circulating water depends directly upon the amount of heat imparted to each pound of water in the condenser. For a minimum pumping cost, the water should leave the condenser exactly at the temperature of the steam entering the condenser. In the surface type of condenser it is necessary to allow for a certain difference of temperature between the steam and the water because of the metallic tubes and the amount of heat transferred is directly proportional to the differential temperature allowed. As the amount of surface is increased the cost will increase in definite proportion, while the differential temperature required will decrease. This permits of a reduction in the quantity of water to be pumped and therefore reduces both the size and first cost of the pumps and also the power required to operate them. With the jet condenser it should be possible to reduce the differential temperature to a few degrees, although it is more common to find the difference greater than in the surface condenser. The greatest inherent advantage of the jet condenser is wasted by operating it with the discharge water at a temperature below 90 deg. when it should be at least 105 deg. There are many considerations which affect the selection of the type of condenser to be

used. Dirty and scaly water calls for a jet condenser, but if the scale is not thrown down in the condenser a surface condenser may be used to advantage if the water can be returned to the boilers and care is exercised not to have it pure distilled, which is believed to attack the iron in the boilers with avidity. It is often possible to effect a very material saving in cost and size of condenser by allowing for a reduced vacuum when the temperature of the water is high. It is then a problem of balancing the added cost of fuel, etc., against fixed and operating charges on the condenser equipment to determine the most economical installation.

With reciprocating engines the gain in economy by the last 1 in. or 2 in. of vacuum is relatively very much smaller than it is on the steam turbine, and the introduction of low-pressure turbines has emphasized the importance of high vacua, which are essential to their successful operation. The daily and annual load factor on the unit also have an important bearing on the condenser. Where the load fluctuates and is considerably below rated output, the question must be looked at in a different light. The important items outside the pump itself are, first, to keep the piping system from the point where the pressure goes below atmosphere to and including the condenser and its auxiliaries, as nearly bottle tight as possible, and, second, to cool the air entering the pump and remove from it as much of the water vapor as possible. In the jet condenser particular attention should be given to the air offtake, which should be so designed that all the air must pass in intimate contact with the cold water entering the condenser chamber. In the surface condenser, proper attention should be given to the distribution of the baffle plates in order to accomplish this result as nearly as possible. Mr. Bump is of the opinion that in many cases the air should be drawn off through a separate chamber in which it is cooled to a temperature almost that of the entering water. This would enable a considerable reduction to be made in the size of the air pump and in the work the pump does. The surface condenser is used almost exclusively on all large turbine installations and has given better results than jet condensers ordinarily show. There seems to be no inherent advantage, however, that would justify any appreciable difference between the two types of condensers. The selection of the pump-driven unit for any condensing installation must depend upon other plant conditions. If the exhaust is needed for feedwater purposes, steam-driven units are installed, and where this condition does not obtain the selection depends on the cost of motor- and steam-driven pumps and on the expenses for operating them.

Cooling towers are divided into two general classes: forced draft and natural draft, the former being used largely in this country. The comparison of the relative merits of the two types involves consideration of climatic conditions, ground space, cost per unit of surface as compared with the cost of fans plus the operation and of the adaptability of towers of varying capacities to the condenser. Temperature and humidity are of greatest importance in cooling-tower design. Mr. Bump gives information on the building of the various types of towers and their operation. Regarding cooling ponds with jets scattered through the pond and discharging into the air, he is of the opinion that unless the pond is already in existence the first cost is prohibitive and the power required for pumping water large. Promising results have been shown on a combination of condenser and cooling tower in which the steam discharged from the unit enters coils of pipes or chambers over which water is sprayed and air rapidly circulated.

Discussion.

Mr. A. R. Cheyney, Philadelphia, pointed out that a low temperature of injection water is necessary for economical operation when the temperature of the air is high. He described some of the investigations which have been made under his direction to study the action of air in the injection water of the condensing system of a 5000-kw Curtis turbine. Six-in bull's-eyes were inserted in the piping and the interior of the system was lighted by incandescent lamps properly waterproofed. The jet condenser has the advantage of low first cost, simplicity of operation and reliability of service. With it a 28-in. vacuum on injection water at 85 deg. Fahr. can be reached. It is cheaper to clean an 8000-kw condenser than the same plant capacity in boilers. Mr. H. C. Abell, New York, discussed at length the detailed types of condensing apparatus and emphasized the importance of considering the annual load curve, in calculating condensing plant economies. In closing, Mr. Bump said that the use of a liberal dimensioned sump under the cooling tower enables water practically free from air to be supplied, and in reference to a plant in Denver stated that the dryness of the air sometimes resulted in the water leaving the tower at a temperature from 6 deg. to 10 deg. below that of the surrounding atmosphere.

Transmission and Distribution.

HIGH-TENSION TRANSMISSION LINES.

The paper of perhaps highest electrical engineering interest presented at the convention was that of Mr. Arthur S. Ives, of Poughkeepsie, N. Y., entitled "Requirements and Specifications for Extra High-Tension Transmission Lines." The paper relates apparently to the transmission system of the Honk Falls Power Company, of Ellenville, N. Y. Several years ago the company with which Mr. Ives is connected constructed about 16 miles of line for 13,200-volt transmission, with the expectation of doubling this voltage in the future. When the matter came up for final decision last year it was decided, however, to use one of the standard transmission voltages recommended by the American Institute of Electrical Engineers, and 33,000 volts was adopted. The alleged difficulties relating to the use of a voltage as high as this were investigated, and it was found that the actual serious disturbances and troubles cited did not begin to develop until a voltage in excess of 40,000 was reached; that many of the difficulties and disturbances that have been experienced on 33,000-volt lines might have been obviated by the use of more substantial construction and design, and by selection of proper sags for the wires, and that the addition of overhead ground wires, properly located and properly grounded, would reduce the danger of troubles from lightning to the minimum even with a voltage as high as 33,000.

The paper includes a standard form of specification for a single-circuit, 33,000-volt, three-phase transmission line with private telephone line, and allowance for one 2200-volt, two-phase primary distributing circuit on the same poles. The specifications comprise 54 numbered paragraphs, following which are notes on such of the paragraphs as call for explanation or comment. Referring to the section on pins, metal pins are strongly recommended for all high-voltage work, and all pins should be threaded for a nipple to be screwed on and cemented into the insulator; by this means a broken insulator can be replaced by unscrewing the nipple and changing the pin. As to spacing of circuits, equilateral triangular spacing is recommended for three-phase lines with the qualification, however, that high-voltage lines seem to operate as satisfactorily with the right-angle triangular arrangement. Forty-eight in. between circuits is pronounced good practice for 33,000 volts. A note on the specification for sags and strains indicates that particular attention was given to this point in designing the line. The use of overhead ground wires is approved, and it is stated that in almost every case a single wire about 3 ft. above the high-tension transmission wire will be found satisfactory. The overhead wire was grounded at every alternate pole except at high and exposed points, where a ground connection is made at every pole. The method of grounding consists in coiling the ground wire several times around the butt of the pole, which is the simplest and probably the cheapest method that can be used, while almost any desired surface can be obtained by increasing the number of wraps around the pole. Sleeve joints are used on all power wires with excellent results, and are considered to be superior to the soldered joint. Aluminum conductors were used for half of the line and copper conductors for the other half, the former being over a section which crosses a particularly

rocky and difficult country. Very careful observations will be made in order to determine whether the use of aluminum will be of advantage in the future.

In conclusion the author recommends to anyone contemplating the construction of high-tension transmission lines the following fundamental rules: (1) Select one of the standard voltages adopted by the American Institute of Electrical Engineers. (2) Secure an adequate and permanent right-of-way, with ample cutting privileges. (3) Build your line with ample strength throughout all of its dimensions and with ample sag in the strains. (4) Use overhead ground wire with frequent grounds. (5) Maintain cordial relations with owners of property through which your line is built.

PROTECTION FROM LIGHTNING.

The report of the committee on protection from lightning, consisting of Mr. B. E. Morrow, chairman; Mr. H. B. Gear, Mr. O. A. Honnold, Mr. N. J. Neall and Mr. J. F. Vaughan, is confined principally to the work of previous committees and to general information available at the present time. Recommendations are given relating to distributing systems as follows: Grounds, spacing, records and inspection. An abstract at length of this report will be found on page 1462.

Discussion.

Mr. D. B. Rushmore, of Schenectady, said that manufacturing companies are more interested in selling arresters to protect the other apparatus which they sell than to make the profits on the arresters. He took exception to the intimation in the report that the aluminum-cell arrester is an experimental apparatus. He thought it out of the experimental stage. He referred to the paper given before the last convention of the Colorado Electric Light, Power and Railway Association, by Clay, giving the successful experience last summer in the protection of the Animas Power and Water Company's lines in Colorado.

Mr. Percy Thomas, of Boston, drew an analogy between fire insurance and lightning protection afforded by arresters and thought the time might come when tables showing the protection afforded by different arrangements might be prepared, and so the cost counted. He saw no use in adjusting aluminum arresters so as to discharge continuously when one line is grounded, thus heating the arrester. Such a low setting is unnecessary for protection.

OVERHEAD LINE CONSTRUCTION.

The committee on overhead line construction, consisting of Messrs. Paul Spencer, chairman; J. F. Dostal, Sidney Hosmer, G. H. Lukes, W. T. Morrison, Farley Osgood and Thomas Sproule, submitted an excellent report covering poles, pole setting and the stringing of line wires for circuit voltages up to 2300 volts. Sixty-eight pages of the report consist of formal specifications for material and methods of overhead line construction, based upon specifications used by the United Electric Company of New Jersey, the General Electric Company, Stone & Webster, Commonwealth Edison Company, American Telephone & Telegraph Company, Central District & Printing Telegraph Company of Pittsburg, and the New York, New Haven & Hartford Railroad. The committee states its belief that the methods given in its standard specifications are in general agreement with standard practice, but that it is not the intention of the committee in specifying any particular way to condemn methods not included, but rather to indicate a standard method where the choice might lie between two or three equally good. The committee then proceeds to discuss certain items of the specifications concerning which there is more or less pronounced difference of opinion, the subjects being cross-arms, soft versus hard-drawn copper wire, braces, strain insulators, guy wire, preservative treatment, galvanizing, pole settings, cross-arm gains, double arms, size of wire and guying. The committee is inclined in favor of annealed or soft-drawn copper line wire. It specified that no size of line wire smaller than No. 6 be used; that up to and including No. 2-0 solid wire should be used, and above that, stranded conductor. There are 13 separate specifications for material, covering poles and fittings, guys, galvanizing, copper line wire with weatherproof insulation, aluminum line wire with weatherproof insulation and rubber-insulated tree wire. The specifications of methods of construction consist of 134 numbered sections, and include about 50 illustrations. Thirty sections are devoted to poles and pole setting, 5 to pole steps, 12 to cross-arms, 3 to insulators, 33 to pole guying and 48 to wire stringing. The construction methods apply to the running of series street-lighting circuits and constant-potential circuits with voltages up to 2300, and including four-wire, three-phase systems on which 2300 distributing transformers may be used.

RECENT DEVELOPMENTS IN SECONDARY DISTRIBUTION WORK.

Mr. W. K. Vanderpoel, of Newark, N. J., presented a paper devoted to relatively new practices in secondary distribution. The author points out the various methods of running primary and secondary mains through the streets, the difficulties often encountered and the methods of overcoming most of them. From the mains to the customer's meter is where divergence begins and to these problems the author devotes the greater part of his paper. He decries the crude forms of overhead service connection often seen, with kinky and crooked wires and haphazard attachment to buildings, and describes many preferable methods which possess besides the feature of tidiness, stability and advertising merit. The conditions back of each case govern the class of construction, and pecuniary reasons may particularly affect the choice of material; but security and continuity of service should rank before cheapness even in the smallest plants. The trend in subway work is also toward improvement in details—more capacious manholes to avoid an awkward mess of cables, transformers, boxes, etc.; properly shaped and drained manholes; ampleness in duct capacity and service copper; methodical separation of primary and secondary cables; discriminate location and direction of conduit; careful tagging of cables; frequent inspection, etc., are but a few of the practices that now prevail. Wasteful investment is not advocated; but advantage might be taken of the experience of installations that were stinted in such things. The author describes some methods in vogue for cutting in customers on subway service and then discusses the subject of transformers. Owing to the broadness of the subject, however, not much more than a general reference is attempted. The selection of insulators having some bearing on secondary-line construction, Mr. Vanderpoel makes mention of a few different practices. Porcelain is displacing glass for all except arc circuits where triple-petticoat, high-tension, glass insulators are employed to distinguish the circuits. Detachable porcelain pot-heads are coming into more extended use for many reasons. Mention is made of an oil fuse which has brought about marked improvement in operation at slight maintenance cost. A copper-fuse wire is placed on a slotted wooden block which is attached to the hinged lid of the iron fuse block. When the lid is closed suitable contacts engage in jaws attached to the line wire, the fuse being immersed in oil. An oil-sealed duct carries away the vapor generated when the fuse blows. The boxes have been used both overhead and underground at ordinary voltages. The author leaves the question of grounded secondaries to the committee having that matter in charge; but suggests that systems operated in closely settled places and having a large and well-distributed number of neutral wires on three-wire secondary mains should have a splendid opportunity to economize in their grounding work by installing a continuously grounded neutral throughout. Reliable grounds are insured by this means. The neutral not only connects to the neutrals of secondary mains, but to all neutrals of independent transformers and also to those of transformers located in vaults in buildings. A decidedly favorable feature is that it keeps all the company's property within its jurisdiction, thereby saving much trespassing and possibly some accidents on private property which might lead to complications. The paper concludes with descriptions of various interior block distribution systems, comprising back yard and basement and sidewalk systems. Absolute right of way should always be secured for this class of work. The author anticipates some disadvantages with the back-yard pole-line scheme and also with the basement and sidewalk systems of distribution.

GROUNDING OF SECONDARIES.

The report of the committee on the grounding of secondaries, composed of Messrs. W. H. Blood, Jr., chairman; L. L. Elden, W. S. Moody, W. T. Morrison and R. S. Stewart, maintained its position of last year, when it presented a resolution, which was adopted by the association, making mandatory the grounding of alternating-current secondary circuits up to and including 150 volts, but prohibiting the grounding of such circuits having a voltage in excess of 150 volts. The arguments offered, however, apply not to 150 volts or over, but to 200 volts or over. The committee holds that the grounding of circuits of 200 volts or over does not protect against high-tension voltage, due to break-down of transformers and crosses with other circuits, which, moreover, are of infrequent occurrence; on the other hand, such grounding subjects the user to the constant risk of a shock of 200 volts or over, which experience has shown may be fatal. It not only believes it inadvisable to compel the grounding of circuits of 200 volts and upward, but considers such practice almost criminal, for it would require one to do an act which might be the direct cause of an innocent user's death. The paper discussed at some length the matter of securing good grounds. An abstract at length of the committee's report will be found elsewhere.

Discussion.

At the conclusion of his report, Chairman Blood said that the two principal things to be considered were, first, the limit of voltage of lines which are to be grounded, and, second, the method of grounding. As to the voltage limit, there is no difference of opinion on lines where less than 150 volts to ground would exist, as all concede grounding to be desirable on them. The dispute is over the higher voltages.

Mr. P. Junkersfeld, of Chicago, while endorsing most of the report, expressed his disapproval of prohibiting grounding where the voltage between any wire and ground exceeds 150 volts, as proposed by the committee and recommended by vote of the N. E. L. A. last year. It might be a serious thing and lead to danger to draw the line arbitrarily at 150 volts. He favored a conservative course, leaving grounding optional above 150 volts. Mr. Philip Torchio endorsed Mr. Junkersfeld's position. Dr. C. P. Steinmetz said that it would be extremely unfortunate should the National Electric Light Association prohibit grounding above 150 volts, because it would be against the recommendations of the American Institute of Electrical Engineers, which are that all circuits up to 250 volts be grounded. Contrary action by these two great associations would nullify or detract from the action of both. A conference by committee with the A. I. E. E. would be desirable. This question of dangerous voltage is mainly a relative one. Deaths caused by 220-volt shocks are rare. The standard distributing voltage in England is 220 volts. We should go slow about declaring the standard distribution voltage in England dangerous to life. It is easily possible to protect a grounded 220-volt circuit so that it will be safe to the user. That is merely a question of proper insulation. It is not possible, however, to protect interior circuits against voltages reaching into the thousands which may accidentally exist by connection with high-tension lines outside a building. The only protection against these abnormal voltages is grounding. As a protection against fire alone, he would insist upon the grounding of all circuits entering an insured building, because a voltage much above normal on an interior circuit not insulated for that voltage is very likely to cause leaks resulting in a fire. It is true that transformers are better insulated than formerly, but extremely high voltages are also more common, increasing the likelihood of line crosses, so that on the whole the danger is as great as ever.

Mr. M. O. Troy, of Schenectady, agreed with the previous speakers. Mr. L. L. Elden, of Boston, said that his company had followed the recommendations contained in the committee report and favored the 150-volt grounding limit. Mr. George H. Lukes, of Chicago, said that in his experience of 15 years there were almost no cases of injury by shocks of 250 volts or less; thousands had received such shocks without injury. Mr. J. R. Cravath, of Chicago, said that a known dangerous voltage of fixed amount caused by a 220-volt grounded circuit could be insulated against easily. A known danger is safer than the unknown danger introduced by the possible existence of several thousand volts on an ungrounded 220-volt circuit.

The convention finally accepted the recommendations of the committee as to the desirability of grounding where the potential to ground is less than 150 volts, but did not concur in the recommendation that grounding be prohibited where the potential between any wire and ground exceeds 150 volts. This latter part was referred back to the committee for further consideration.

Lamps and Illumination.

REPORT OF LAMP COMMITTEE.

The lamp committee of the association, consisting of Messrs. W. W. Freeman, chairman; W. H. Atkins, John F. Gilchrist, W. H. Johnson, Frank W. Smith and F. S. Terry, reported that 200 replies were received to queries sent out to members of the association relating to lamp methods and practices. More than 60 per cent of the companies reporting have in use a considerable portion of graphitized-filament or Gem lamps, and it is said that several of the larger companies propose during the coming year to substitute this lamp entirely for the ordinary carbon-filament lamp for all free renewals. About 75 per cent of the companies reporting have used the tungsten lamp, and about 20 per cent have used the tantalum, although the employment of the latter appears to be becoming less rather than greater. About 75 per cent of the companies reporting make extensive use of the tungsten lamp, and are encouraging its introduction generally. The reports indicate considerable difficulties with the early lamps, but later deliveries show a decided improvement, and there is an almost unanimous opinion that the tungsten lamp is the best possible means for making satisfied customers and producing additional revenue. The report gives considerable prominence to the Gem or graphitized-filament lamp, which, it states, has been adopted by some of the largest companies to the entire exclusion of the ordinary carbon lamp of corresponding units. The committee expressed its belief that this policy can be generally adopted by a number of companies to their advantage, and that notwithstanding the rapid increase in the use of tungsten lamps the Gem lamp will remain for at least several years to come the standard lamp furnished generally on a free-removal basis. The chief development during the year has been in tungsten lamps. It is stated that these can now be had in all reasonable quantities in standard sizes from 25 watts to 250 watts, and in several special sizes. The early trouble of breakage in handling and shipping, and early blackening, while still existing to some extent, have been greatly lessened, and the committee looks forward to a continued improvement in tungsten lamps, and also to lower prices. The committee advocates without hesitation the open policy of offering tungsten lamps to customers upon favorable terms, coupled with their use in aggressive campaigns for new business.

Discussion.

Mr. Preston S. Millar, of the Electrical Testing Laboratories, presented by means of lantern slides curves of tests being carried out on American and foreign-made tungsten lamps as referred to in the committee's report. While these tests are not finished, the results up to date, as presented by these curves, were very interesting. The American-made lamps are showing decidedly better uniformity and life. In the tungsten lamp, unlike the carbon-filament lamp, the decline in candle-power is due almost entirely to blackening of the bulb. The curves of candle-power at various numbers of hours burning are of the same general shape as those of carbon lamps; that is, there is a rise of candle-power the first few hours, then a gradual decline. Three makes of tungsten lamps which have been under test for 1000 hours are showing a decline in candle-power of the survivors of 3 to 19 per cent. One make of American lamps, of

which a considerable number is being tested, is making a remarkable showing with few burn-outs in 1000 hours. He called attention to the fact that the life and maintenance of candle-power are best on the 60-watt lamps. Mr. J. W. Cowles, of Boston, spoke in favor of a systematic method of delivering and renewing consumers' lamps. In Boston teams are sent out to make certain circuits on certain days and a calendar is sent out to consumers telling them on what day this team with lamp renewals is due. This plan had worked very well and helped insure good service. Mr. M. S. Seelman, of Brooklyn, said that his company had discontinued supplying the old 16-cp and 32-cp common carbon-filament lamps, and in their place supplies the 50-watt and 80-watt Gem lamps. Mr. C. L. Edgar, of Boston, thought that the manufacturers could not well dictate to central-station companies how they should handle the supply of lamps to central-station consumers, but he thought the manufacturers' objections to the sale of lamps by central stations below list prices, to those not central-station consumers, should be well taken. Mr. Farley Osgood reported having followed the Boston system of lamp renewals outlined by Mr. Cowles and by so doing had done away with the promiscuous renewing of lamps which formerly became at times objectionable. In answer to a question, Mr. Cowles said that the cost of maintaining wagon delivery lamp-renewal service in Boston last year for about 1,000,000 lamps was 1.4 cents per lamp. Mr. F. W. Willcox, of the General Electric Company, strongly urged that central stations should replace the ordinary carbon-filament 16-cp and 32-cp lamps with the Gem lamp, and that the tungsten be reserved for those who will pay the price for it.

THE REGENERATIVE-FLAME LAMP.

In his paper with the above caption, Mr. A. J. Mitchell, of the Adams-Bagnall Company, describes the regenerative-flame lamp built by his company. The lamp is already familiar to our readers, its foreign prototype having been described in the Digest from time to time and the present lamp having been illustrated and described in the May 27 number. The author adds a description of the lamp mechanism to what has already been published, and makes comparisons with flaming-arc and other arc lamps, assuming certain rates for electrical energy. The over-all length of the lamp is 36 in. and weight about 40 lb. The movement in both the multiple-alternating and direct-current lamp consists of one coarse wire solenoid with an armature of special laminated iron in the alternating-current lamp; an equalizing lever encircling the center tube and pivoted on it and connected at its opposite end to a dash-pot, which is rather larger than usual and equipped with a metal plunger having a ball-and-socket connection to the stem. The clutch and lifting rod are of standard design. In the alternating-current lamp a coil spring is interposed between the armature and equalizing lever to absorb vibrations. Connection to the upper carbon is made through a coiled flexible copper cable contained in the carbon tube. The lamp mechanism is enclosed in a heavy sheet-copper case and well protected from the weather as well as from the gaseous products of the arc. At the end of a 70-hour run there is a very slight efflorescence on the upper end of the inner globe, but not sufficient to intercept the horizontal and downward rays or cause any perceptible dimming of the light. The lamp is trimmed in a similar way to the ordinary carbon arc with closed-base inner and open-base outer globe. The equipment of the lamp includes an external steadying resistance in a separate case or jacket. The 220-volt lamps are designed to operate two in series with sufficient resistance in one jacket. These are identical in construction with the 110-volt lamps except for the addition of a shunt coil which is designed to encircle the dash-pot, which is made of smaller diameter to allow the necessary space for winding. Photometric curves show that the angle of maximum intensity with reflector removed very nearly approaches that of a direct-current enclosed-carbon lamp, thus making it suitable for street lighting. The power consumption on direct current is from 400 watts to 440 watts and on alternating current from 450 watts to 490 watts, with a ratio of about 5 to 1 in luminous efficiency in favor of the regenerative lamp.

THE PRESENT STATUS OF THE ARC LAMP FOR STREET AND INTERIOR ILLUMINATION.

Mr. N. R. Bridge, of the General Electric Company, described the luminous-arc lamps made by his company, together with the station apparatus required to operate the 6.6-amp direct-current luminous lamp, more familiarly known as the magnetite-arc lamp. The alternating-current luminuous-arc lamp, better known as the titanium-carbide lamp, is also described and detailed costs of operating one as compared with the other given. No details are vouchsafed on the flaming-arc lamp shown and only meager information on the "intensified arcs," the name of a new line of direct-current enclosed-arc lamps having small positive upper carbons, about 0.25 in. in diameter, and larger negative lower carbons, the latter being actuated by the lamp mechanism which regulates the arc.

RECENT TYPES OF ARC LAMPS AND THEIR OPERATION.

The author of this paper, Mr. C. E. Stephens, of the Westinghouse Electric & Manufacturing Company, only touches on a few of the most important characteristics of open arc, enclosed arc and flame arc lamps from the viewpoint of their efficiency as light sources, their advantages and field application. The old habit of comparing arc lamps on a mean lower hemispherical candle-power basis has been more or less superseded by the practice of basing the comparison on mean spherical candle-power and distribution curve. Included in the paper are curves of light distribution of a direct-current open arc, an alternating-current open arc, a direct-current enclosed arc, a direct-current flaming arc and a Westinghouse metallic-flame arc. The apparatus required for the arc-lighting system is also considered. On account of the simplicity of wiring, the series constant-current circuit will no doubt be employed for a long period in the future for arc lamps in street service. In the majority of central stations delivering alternating currents auxiliary apparatus is required for converting to direct current. Until recently the only practical source of constant direct current was the arc machine, and while these are now operated by motors, the scheme possesses many disadvantages in the opinion of the author, who prefers the mercury rectifier. The efficiency of the latter system averages about 88 per cent. The other system in use consists of the series alternating-current enclosed lamp with a constant-current regulating transformer. The author in his conclusion compares the different systems. The open arc has been replaced by the enclosed arc for street and interior lighting, although for the latter service it is possible that the high-efficiency incandescent lamps will replace the arc. The flaming-arc lamp is adapted for very large interiors, railway stations, factories, etc., where the fumes of the lamp and the color of the light are not objectionable. The high efficiency of the lamp depending upon the yellow light, the author fears that the color element will prohibit the use of flaming arcs except within a limited field. The advantages of the metallic-flame arc are found in its efficiency as a light source, its low maintenance cost, its light distribution for street illumination, the color of the light and the fact that it can be operated with small current values. The lamp is designed for 4-amp series circuits and is fed from 25-light to 100-light rectifier outfits.

Discussion.

The papers of Messrs. A. J. Mitchell, N. R. Birge and C. E. Stevens were discussed together. Dr. C. P. Steinmetz voiced his interest in the above papers, stating that the two dealing with the luminous type of lamp were the more important. He said that the flaming lamp is not as new as many engineers claim, several having been built as early as 1902. Thus far the flaming-arc lamp has not made any great headway against the luminous type of lamp as exemplified in the titanium and magnetite arcs. Possibly it is handicapped by the higher cost of electrodes and unsatisfactory color. It is not suited to general illumination in American cities, a whiter light giving

better results than the orange and yellow rays of the flaming lamps. White flame carbons having any efficiency worth speaking of have not been available before. It is a serious disadvantage that the cost of electrodes for a life of 70 hours comes to 50 cents per trim, which is 20 times the cost of electrodes for the magnetite lamp. The 6.6-amp magnetite lamp, with 65 per cent more power consumption than the 4-amp magnetite, gives 135 per cent more light than the latter, and it also gives an excellent side illumination. We should be interested in getting the same light for less money, as well as more light for the same money. Dr. Steinmetz criticized "mean hemispherical" candle-power measurements, stating that the mean spherical candle-power figure is preferable from a practical point of view. Special attention should be given to the study of distribution curves with particular reference to angles of about 60 deg. below the horizontal. The use of enclosing globes must inevitably reduce the brilliancy of the light in the larger units. Opal, frosted and sand-blasted globes are not mutually equivalent. The opal globe acts as a secondary generator, the light coming from the globe as an illuminant. We can modify the distribution curve by the shape of opal globe used, which is a very practical consideration. The frosted globe breaks up and scatters the light. With the alternating-current enclosed carbon arc lamp the use of an opalescent globe enables a large amount of light to be thrown to the horizontal plane. The direct-current enclosed carbon arc has a greater efficiency than the alternating-current enclosed arc. In the direct-current lamp all the heat is concentrated at the positive carbon, which gets hotter and more efficient than in the alternating-current lamp. In the flame arc most of the light is given by the flame, whereas in the magnetite arc all the light is given by the flame. The carbon arc increases in efficiency as the size of the carbon decreases. The effect of the size of the electrode disappears in the luminous arc, and the efficiency is not thereby limited. An electrode of diameter gives better light and longer life. Diameters as great as ⅝ in. or ¾ in. are thoroughly satisfactory, and the color is improved as well as the efficiency.

Mr. E. W. Lloyd, of Chicago, stated that there are about 500 flame lamps in advertising use in that city. They are best adapted to buildings of large area, such as warehouses and depots. The small storekeeper does not care for them, especially when he has to buy two at a time. The effect on the eye opposes the most scientific methods of illumination. These lamps are of little use where the ceilings are low.

Mr. J. W. Cowles, of Boston, stated that the Boston Edison Company was in no small degree responsible for the local demand for more light in that city. He described the investigations which were made prior to the signing of the recent street-lighting contract, stating that the luminous arc offered the best results of all the lamps considered. The 6.6-amp magnetite lamps now being installed promise excellent results on the high poles used. Opal globes are included in the installation. These lamps will give easily two to three times the volume of light and better distribution than that of the lamps formerly in use. Mr. Birge's cost figures are no doubt correct for lamps of the some general type, but it is important to realize that they do not cover all the costs incidental to arc-lighting service.

MANUFACTURE OF INCANDESCENT LAMPS.

Messrs. J. E. Randall, Glen C. Webster and S. E. Doane, in a paper entitled "Manufacture of Incandescent Electric Lamps," described in detail the various processes involved in the manufacture of carbon-filament incandescent lamps. The first half of the paper relates specifically to carbon filaments, and in the second part some of the information applies to metallic-filament lamps, though the special details of the manufacture of this type of lamp are not given. It is stated that the lamp manufacturers of this country run 50,000 lamps a year on life tests, under exact conditions, until each has made a complete record of its life, the cost involved being about $100,000 annually. In the manufacture of the carbon lamp there are 60 principal operations, and about 18 inspections. From records kept of complaints for the last two years, it is demonstrated that 90 per cent of all complaints relating to carbon lamps are not the fault of the lamp, but due to use under conditions rendering it impossible to give the service expected. Among recent improvements noted in lamp manufacture are the use of a moisture-proof cement for attaching bases; better quality of frosted bulb lamps; thorough and systematic inspection and rigorous sorting; refinement of exhausting processes; better filament joints and improved method of sealing-in.

Discussion.

Mr. Doane, in answer to a question as to the percentage of breakage of different parts in manufacture, said that the breakage on bulbs ran from 7 to 10 per cent; on filaments, 20 to 30 per cent, and on tubing, from 4 to 5 per cent. Should breakages of all kinds be eliminated in the manufacture, it would probably reduce the total cost about 20 per cent.

STREET AND PARK LIGHTING.

In a paper entitled "Developments in Street and Park Lighting" Mr. J. W. Coles, of Boston, treated the subject under the heads of urban streets, suburban streets, parks or boulevards and display lighting. For urban street lighting the amount of energy required per mile of street to give satisfactory illumination ranges from 3.5 kw to 20 kw, 10 kw representing the most common practice. Various systems of urban street lighting are discussed, and the lighting of Seventh Avenue above 110th Street in New York City is referred to particularly. Center and intersecting corner lamps are here used, the latter on mast-arms to avoid the trees. With an expenditure of 26 kw per mile measured at the arc, or 40 kw measured at the lamp terminals, an illumination is secured with an almost entire absence of shadows that is most gratifying and without any impression of being overdone. For suburban lighting the series tungsten lamp, with such reinforcement of arcs as may be required in prominent locations, is recommended. Forty-cp incandescent lamps appear to be preferred, although 60-cp and 80-cp lamps are used in occasional cases. To meet the usual park or boulevard regulations a combination of both urban and suburban practice appears to offer the best results, while tungsten incandescent lighting has proved itself well adapted to park use. In conclusion the author warns against the adoption of the "more light" slogan without proper regard to the laws of both illumination and common sense. A tremendous blaze of light directly within the vision of both the walking and riding public is not necessarily progression in its best sense, and may result in retardation rather than advancement of the art. More intelligence should be applied than has been done in the past to the spacing and location of street lamps in order that more uniform illumination may be obtained.

Discussion.

Mr. S. G. Rhodes, of New York, called attention to the point that in the lighting of parks, boulevards and heavily shaded streets, the lamps must be placed low so as to be under the foliage. Tungsten lamps placed from 10 ft. to 11 ft. high are good. However, units of such small capacity as 75 watts cannot well be supplied from underground distribution to ornamental posts on account of the first cost. As it is an expensive matter to get up temporary designs in cast iron, some full-sized wood and plaster paris models of posts had recently been submitted to the Municipal Art Commission and served to give a good idea of the proposed designs. Mr. Farley Osgood, of Newark, speaking of the installation of 1130-watt flaming arcs placed 100 ft. apart, at a height of 18 ft. on one of the streets of Newark, said that the criticisms of this installation as having a blinding effect and being bad from an illuminating standpoint were justified. A height of 40 ft. was shown to be more pleasing, and was recommended by illuminating engineers, but the merchants on the street insisted on having the lamps low. The effect of such brilliancy on the street had been to force the merchants to furnish more light inside of their stores, so that the revenue from commercial lighting had increased. The revenue from window lighting had decreased slightly because of the large amount of light on the street. About 90 more lamps were to be put in about 100 ft. apart on another street. These would be 25 ft. high.

THE EFFECT OF VARIOUS MAINTENANCE CONDITIONS ON THE EFFICIENCY OF ILLUMINATION.

Mr. A. L. Eustice, of the Nernst Lamp Company, notes in his paper the vast difference between laboratory performance of illuminants when everything is new, and the results obtained in actual practice when deterioration has set in and possibly the venerable dust of ages has accumulated on the glassware. As a result, a system does not in many cases come up to the owner's or designing engineer's expectations. The importance of periodic and systematic maintenance was appreciated by the author, who in order to arrive at definite conclusions made extended investigations, the results of which are embodied in his paper. The relation of the deterioration of a system of illumination due to the dirty condition of the glassware, the working efficiency or average illuminating results to the cost of maintenance are questions of importance which will receive more attention when the illumination actually produced is made the basis of payment. The author was unable to include information on some forms of commercial reflecting devices, such as opal, opalux, satin-finish, etc. Whatever may be said relative to the effect and loss of illumination due to lack of periodic maintenance, the great losses found in some cases, especially in the case of dirty *versus* clean prismatic systems, where by cleaning the glassware the contrast between the clean and sparkling and the dirty was unmistakably apparent, show the necessity of some inspection and indicate to what extent maintenance enters into illuminating systems.

Discussion.

A brief discussion was offered by Mr. E. L. Miller, of New York, who emphasized the importance of washing prismatic reflectors, rather than depending upon wiping with a cloth.

QUALITY OF LIGHT.

Prof. Paul F. Bauder, of Chicago, delivered an interesting lecture on the "Quality of Light," illustrated by lantern slides. The lecture consisted to a great extent in explanations of numerous pictures thrown on the screen and therefore does not admit of abstract. The latter portion of the lecture related specifically to artificial illuminants, in which the characteristic qualities of daylight were compared with similar qualities of the various types of incandescent, glower and arc lamps.

Transformers and Meters.

THE PRACTICAL ASPECTS OF RECENT IMPROVEMENTS IN TRANSFORMERS.

That a very great advance has been made during the last few years in the design and performance of transformers is generally known, and Mr. W. A. Layman, of the Wagner Electric Manufacturing Company, points out the way in which some of these improvements have been secured as well as the dangers involved in pursuing the possibilities of the present art to too great extremes. A comparison of the internal energy losses in transformers shows the great gain made because of the use of alloy steel. The weight of the transformer, core loss and copper loss have all been greatly reduced by the judicious use of the new material. If the transformer be designed for a density of magnetic induction above the limits considered desirable for high-grade apparatus, the labor and material cost may also be considerably reduced; but the author points out that such transformers will be subject to pronounced and serious objection by reason of the high magnetizing current absorbed. High induction inevitably leads to high leakage current, which rises rapidly under excess voltage. The natural effect of lower losses in present-day transformers has been to lessen the heating problem, which in turn has resulted in a reduction of dimensions. The latter proposition has given rise to the necessity for increased care in internal insulation, and the author directs attention to the ill effects of the application of test pressure, which, if unduly prolonged, results in a gradual impairment of the insulation. The author recommends that all users reduce the requirements for insulation testing for periods of 10 to 20 seconds, and that the prescribed pressures be double the normal operating pressure. This recommendation applies particularly to transformers wound for the higher voltages.

Discussion.

Dr. C. P. Steinmetz protested against any shortening of the high-voltage test, which would mean a lowering of standards. The A. I. E. E. recommendation of double normal voltage applied for two minutes is not hard upon the manufacturer. Mr. W. G. Reed, Pittsburgh, coincided with this view. Mr. W. S. Moody, Schenectady, pointed out that American companies overcame the difficulties in the way of producing silicon steel four or five years ago, in advance of the Germans. Silicon steel is especially valuable in current transformers, since it is more permeable at low magnetic densities and less so at high fluxes. High density at the joints of the magnetic circuit makes it necessary to provide for reduced permeability in transformers for constant-potential service. In conclusion, Mr. Layman said that he did not agree with Dr. Steinmetz regarding the two-minute voltage test, but protested against incorporating five to 30-minute tests in modern specification writing.

DISTRIBUTING TRANSFORMERS AS OF INTEREST TO CENTRAL STATIONS.

Mr. E. G. Reed, of the Westinghouse Electric & Manufacturing Company, traces the development of distributing transformers from the classic experiments of Henry to the present day, shows the essential requirements of transformers of this class, and then discusses their electrical and mechanical characteristics. The service requirements of transformers mounted on poles or in manholes are identical as to performance, but differ in other particulars. As to performance, it is admitted that the iron and copper losses should be low, the former being the lower of the two since it is continuous. Assuming a certain cost for energy, the author traces the effect of various iron and copper losses, and how one might be reduced and the other increased under certain conditions without jeopardizing satisfactory service. Taking up the new steel used in transformers, the author directs attention to the ill effects of high exciting current resulting in lower power factor. He points out the various factors which should be considered when purchasing transformers and the characteristics essential to parallel operation. The various tests are outlined and curves showing the operating characteristics of existing transformers are given.

Discussion.

Mr. H. W. Peck, Rochester, emphasized the relation of the copper loss and the peak load. The fact that about 50 per cent of the plant investment has to be charged to 3 per cent of the output tends to increase the cost of the copper loss. Mr. Ives, Poughkeepsie, stated that the temperature of the transformer coils is not necessarily given by the reading of the thermometer placed in the oil. The temperature gradient between the coil and the oil varies in proportion to the square of percentage of load. If there is a temperature drop of 10 deg. between the oil and the coils at full load, there would be 2¼ times this drop at 50 per cent overload. The discussion was concluded by Mr. M. A. Sammett, Montreal, who brought out the importance of reducing the exciting current. In a recent test of three 30-cycle, 100-kw, 2200-volt transformers the exciting current was 12½ per cent of the full-load current at 2200-volts and 19 per cent of it at 2420 volts.

METERS.

The report of the committee on meters, consisting of Messrs. George Ross Green, chairman; G. A. Sawin and L. E. Sinclair, is a voluminous document comprising no less than 278 pages and thus naturally not admitting of satisfactory abstract. Sixty-seven illustrations, some in half-tone, are included, and answers are printed to 108 questions submitted to members of the association. Twelve letters are also printed which were received in reply to a communication sent out by the meter committee on the subject of "Flat Rate versus Meter." About 100 pages of text consist of a treatise on the principles of meters and methods of testing, written by Mr. Burleigh Currier. The above matter forms three appendices to the report. The main part of

the report occupies 103 pages, with the following heads for the various divisions: Introduction; accuracy of meters; meters; meter department; meter installation; meter testing; meter tester's tools and appliances; meter records; meter constants; reading meters; complaints; shop and laboratory; instructions; serially numbering meters; statistical information; flat rate versus meters; scope of the meter committee; conclusion. The report does not appear to give a resumé of the information received in reply to queries addressed to members, except in the case of those relating to flat versus meter rates. In regard to the latter it is stated that the consensus of opinion of replies received is that the meter basis is far superior to the flat rate. The committee does not consider that signs, arc lamps, window lighting and the like, controlled by time switches and charged for at a fixed rate per month, should be classed as on a flat basis, since it is actually on a measured basis. The committee believes that while the flat-rate basis may be desirable in exceptional cases, as in that of a small company with limited territory for expansion, whose total revenue does not greatly exceed the expenses, where the adoption of the meter basis might result in a decrease of the amount of business, in a great majority of cases the flat-rate system is far inferior to the meter basis. Some of the opinions received were to the effect that all companies recognize the practical necessity of installing meters, and, therefore, the flat-rate question is dead; some of the opinions, however, were that in view of the fact that many companies are still using the flat-rate system, especially since the introduction of high-efficiency lamps, the question is very much alive.

Discussion.

Mr. Green reviewed the contents of the report and laid special emphasis upon the importance of adequate maintenance for all meters in central-station service. He then called attention to the meter exhibit of the association on the pier, pointing out the great care with which it had been assembled and its educational value to all those in attendance at the convention. Mr. Green read a letter from Dr. E. B. Rosa, acting director of the Bureau of Standards, Washington, D. C., condemning the use of the term "wattmeter" and recommending that "watt-hour meter" be substitued for it in all future terminology. Mr. J. W. Cowles, of Boston, referred to the report in complimentary terms and touched upon the legal and moral responsibility of the central station for keeping meters in the best possible condition. Many companies are not yet awake to the importance of small improvements in the accuracy of meter registrations. Accurate tests of these instruments under service conditions are very important, and this work is greatly facilitated by recent improvements in portable measuring apparatus. Systematic tabulation, enabling comparisons to be made, are essential. Mr. C. D. Haskins, of Schenectady, said that the report is the world's first text-book on meters, and that it is extremely valuable. The accuracy of electric meters as compared with apparatus for the measurement of water and gas is now fully established.

Mr. J. D. Hutchings, of Rochester, N. Y., urged the larger companies to help the smaller ones in meter testing. The highly organized meter departments of the larger stations should be placed at the disposal of less favored companies at minimum expense. Mr. Eichert, of Brooklyn, pointed out the opportunity to save money by avoiding all but the most necessary meter tests. Variations in a customer's bill are a reasonably fair index of the conditions. Mr. C. G. Durfee, of Rochester, spoke upon the necessity of installing meters free from the possibility of tampering. Mr. Samuel Insull, of Chicago, said that the cost of meters is very important in connection with the use of tungsten lamps in small apartments. The consumer in some cases is now paying $30 per kilowatt of meter installation, f.o.b. cars, and this is something worth reducing if possible.

THE METER EXHIBIT.

One of the unique and valuable features of the convention was the exhibit of the meter committee, which occupied a space of about 12 ft. x 18 ft. in one corner of the exhibition hall. It is doubtful if as much information per square foot of exhibit space could be found in any other display in the hall. The object of this exhibit, which was the first of its kind that has ever been made, and which was entirely non-commercial in character, was to supply the convention with the latest and most complete information and educational matter available in relation to the broad subject of meters and their applications. No one could doubt the importance of the exhibit and subject who realized the facilities which were there available for sounding the subject to its depths. The exhibit was arranged at the expense of much time and money, and its success was largely due to the co-operation of several of the large manufacturing companies and central stations, and to the time which many gentlemen having an expert knowledge of meters freely accorded to visitors.

The New York Edison Company, Philadelphia Electric Company and Rochester Light, Heat & Power Company showed meters and equipment for preventing theft of current, including outfits for meter testing. The Washington (D. C.) Electric Light Company also showed portable testing equipment. A large number of modern meters and rotating standards were shown by the General Electric, Fort Wayne, Duncan and Westinghouse companies. An oscillograph, with negatives of alternating-current waves, was shown by the General Electric Company. A number of meters of different type and storage-battery testing sets and load boxes were shown by the Public Service Corporation of New Jersey.

At the front of the exhibit was an illuminated set of meter dials about 6 ft. long and 3 ft. wide, connected so that instruction could be given in reading. There was a display of armature winding lathes driven by small motors, and at one side of the exhibit was located a display of jewel bearings, including the Currier sapphire jewel and shaft end, the latter being shown under an electrically illuminated binocular microscope. A large collection of repairing and adjustment tools, stop-watches, testing switchboard panels, charts of meter department organization and test methods, diagrams of wiring with raised parts of meters attached, graphic records of instrument standardization, motor-driven disks to show eddy current generation through the voltmeter, a potentiometer, photographs of testing departments, copies of all the meter patents in the U. S. Patent Office, the best books on the subject of meters, fuses, forms and blanks from many companies were shown. Over 100 packing boxes were required for the transportation of the exhibit. The exhibit was arranged by Mr. George Ross Green, Philadelphia, assisted by Messrs. Sinclair, of Washington, and G. A. Sawin, of the Public Service Corporation of New Jersey. Mr. Currier, of Philadelphia, was in charge of the exhibit.

Miscellaneous.

REPORT OF THE COMMITTEE ON PROGRESS.

The report of the committee on progress, consisting of Mr. T. Commerford Martin, which covers 64 printed pages, opens with a statistical account of the central-station industry, compiled from the report just issued by the United States Bureau of Census for the year 1907, supplemented by data compiled for the *McGraw Electrical Directory*. The heads of the report are as follows: Foreign data and conditions; comparison of European methods; rates and franchises; conservation of natural resources; franchise questions; municipal ownership; newer central-station plants; special street lighting; metal-filament lamps; flaming arc; other lamps and illuminants; current-selling methods; electric automobile propaganda; refrigeration and ventilation; progress in electric heating; miscellaneous topics; electricity and public safety; fostering the contractor; central-station welfare work. The statistics show that there are 5111 American central-station plants, of which 1252 are municipal plants; 555,921 arc lamps are in service, and 41,807,944 incandescent lamps, while the total horse-power capacity of stationary motors connected is 1,649,026.

NEW YORK HIGH-PRESSURE WATER SYSTEM.

A paper with the above title by Mr. Arthur Williams, of the New York Edison Company, describes the high-pressure service for fire protection recently completed in New York City. The service is divided into three sections: Manhattan, Brooklyn and Coney Island. The last section is fed from gas-engine-driven triplex pumps, while the other two are fed from electrically driven centrifugal pumps, energy for which is supplied from the mains of the Edison Electric Illuminating Company in Brooklyn and from the mains of the New York Edison Company in Manhattan. The pumps are direct-connected to 800-hp, 6600-volt, 25-cycle induction motors and each of the stations has a capacity of 15,000 gal. of water per minute. Mr. Williams describes the feeder system for supplying the energy to the stations and the precautions taken to guard against failure in the supply in Manhattan. The contract with the city provides for the payment of a forfeit of $500 per minute for any interruption of over three minutes. The cost of the high-pressure water system on Manhattan was practically $4,000,000, and the cost of operation, including allowances for interest, the sinking fund, operating expenses and the electrical service, will probably not exceed $350,000 annually. The fire department will eventually discard the portable pumping engines and rely upon the high-pressure system in the sections where it is available. The maximum pressure at the hydrants is 300 lb. per square inch. The Oliver Street station was put in operation in January, and to date has consumed 55,000 kw-hours of energy. In the same period the Gansevoort station has consumed 9735 kw-hours.

Discussion.

In explanation Mr. Williams said that the charge for this service is $22 per year per kilowatt of maximum demand and 1½ cents per kw-hour. This system absolutely insures the community from serious fire loss. It is far superior to the old horse and engine method in a large city and when generally applied will bring about a great reduction in the fire waste. For this service the company cannot count upon large kw-hour sales. The system is used practically exclusively in the down-town section of New York. It is a kind of service which can only be supplied under some maximum-demand system. The company renders a great public service here at a fair percentage of profit. Normally the system is filled with fresh water and it supplies water at a pressure of 300 lb. per square inch compared with a maximum of 125 lb. from the ordinary horse engine.

PRIVATE POLICY.

Mr. Paul Lupke presented a characteristic paper with the title "Private Policy," in which he treated of a variety of subjects in a style that has made his contributions one of the features of convention sessions. At times humorous, and always clever in phrasing, the message conveyed is nevertheless always one of shrewd common sense. Referring to the stress now being laid upon the necessity of establishing and maintaining a correct public policy, it is pointed out that the most elaborate public-policy structure will in the end prove a mere castle in the air unless it rests solidly upon the rock bottom of an unassailable private policy, which latter is defined as the provision of the right plant and the right men. While advocating the adoption of the latest improvements, and warning that even these in a few short years may become obsolete, he advised that every reasonable effort should be put forth to confine new things that require new conditions to new plants, quoting in this connection the old injunction about plowing with an ox and an ass under the same yoke. Having provided the best plant warranted by conditions, it is next in order to maintain an operating force that will do it justice. There are two ways of making a station fool-proof—one is to make all of its apparatus proof against fools, and the other is to eliminate all the fools. Mr. Lupke expressed his belief that the first plan has been worked a little too hard, and the second not quite enough. A strong plea is then made for maintaining cordial relations with employees. When hired employees are held to certain obligations, which necessarily implies that the employer is himself under certain obligations to them, and the efficiency of an organization depends upon the degree in which every one connected with it recognizes and lives up to the mutual obligations their respective positions and relations impose.

With good men the accomplishment of a desired end is largely a matter of good example, but such example must not be superficial or spasmodic, but a sustained, quietly enthusiastic devotion to duty for its own sake. The effects of frantic revival peaks are not lasting, as too many reconversions will be found necessary. In reply to the objection, "What's the use? As soon as a man reaches the point where he is good for anything he quits," it is asked, what good to one is a man who cannot get a job anywhere else? He quoted with approval what a liberal-minded man, who is making a marked success of the education of employees, has to say on this point. "He (the employee) is told that if there are not sufficient vacancies to make promotions reasonably certain, better positions outside will be found for those who are qualified to fill them." The whole trouble of handling the employee might, he says, be pressed into one sentence—make a man of him and treat him like one. In conclusion, the author suggested that the National Electric Light Association might with benefit establish a certain well-defined standard of trustworthiness and faithfulness to duty, combined with a practical and theoretical knowledge for each and every class of men in the service of the central station—for firemen, engineers of various grades, switchboard men, meter men, linemen, lamp men, solicitors—up as high as you like, but be sure and start from the bottom; then if a man established competency under this prescribed standard there should be issued to him a certificate or diploma as a graduate National Electric Light Association fireman, engineer, or whatever the case might be. Such a plan, he states, is in line with the most progressive and practical ideas thus far advanced.

MEMORIAL.

Mr. T. C. Martin, committee on memorials, said that the association had been fortunate during the last year in losing no member who had been active in its work. He referred, however, to the death of Gen. A. K. Stiles, the financial backer of Mr. Charles J. Vandepoele, the famous inventor in electric lighting and railway fields. He also referred to the death of Mr. J. V. S. Church, for so many years connected with the *Electrical World*.

Commercial.

CENTRAL-STATION OPERATION OF STEAM PLANTS IN CONNECTION WITH LIGHTING COMPANY'S SERVICE.

It has been advocated time and again that if a central station supplied steam for heating purposes in addition to electrical energy, the chief cause for isolated plants would be removed. A different scheme is, however, described by Mr. S. M. Bushnell, of Chicago, who outlines the system adopted by the Commonwealth Edison Company of Chicago for supplying heat in that city. The company promoted the organization of an independent heating company which is named the Illinois Maintenance Company, because its function is to operate and maintain steam-heating plants, elevators, etc. The plan of operation differs somewhat from that which has been followed in most cities. No central heating station was installed and no general system of pipes and conduits was laid. The company has worked along the lines of a very simple policy. Where lighting customers are perfectly satisfied to operate their own steam-heating plants and where they are not inclined to over-exaggerate the cost of operation, no attempt is made to secure the heating business. In cases where the cost of steam for the building becomes a menace to the use of central-station energy, a careful estimate is made of the costs of operating the steam plant and the Maintenance Company offers to take the contract for a term of years, usually five, at a certain fixed price, or in a few cases, at a certain fixed price per 1000 lb. of steam. In a great many cases the mere fact that the customer is able to contract for his steam at a certain fixed price causes him, or

his engineers, to figure that he can operate the heating plant himself at a cheaper price. Accordingly the contract is made for electricity and the customer reserves to himself the operation of his steam-heating system. Occasionally, however, the customer takes the position that if he is to omit any portion of the operation of his plant, he would like to be relieved of entire responsibility and makes contracts not only for electrical energy, but for heating also. In such cases the heating company steps in and closes the contract for the operation of the steam-heating plant, while the central-station company makes the corresponding contract for furnishing the electricity. The organization for taking care of the steam-heating contracts is simple. There are two men who act as visiting engineers and who keep a constant supervision on all the plants, employ the men, order supplies and visit the different plants during the day and night to see that they are kept in efficient operation. They report to the manager, who in turn reports to the vice-president. The strictest discipline is maintained in all the plants, and the fact that there are so many engineers and firemen employed in the various plants enables the visiting engineer at all times to have men at his disposal to fill the place of any man found to be incompetent. Some idea of the scope of the work is given by a description of the principal plants now being operated by the heating company. The method of estimating and contracting for steam, and also some of the principal formulas used in estimating the cost of steam in buildings, are included in the paper. For the 27 buildings now heated, the Edison company derives an income of more than $160,000 per annum from the sale of electricity at remunerative rates. More than 100 contracts for buildings in the downtown district have been secured, where the heating estimates of the Illinois Maintenance Company were important factors in securing favorable decisions for the central station. Considered apart from the lighting company, the proposition in Chicago is not a paying one; but when considered in connection with its effect on the business of the lighting company the venture is very profitable.

Discussion.

Mr. Paul Mueller, Erie, Pa., condemned the practice of supplying steam heat on a flat rate. The waste of steam is considerable under such conditions. His company uses the condensation type of meter, and heats all the large buildings in the city. The atmospheric system will sometimes save the consumer 40 per cent of his heat. It is imperative that the system shall be in perfect order if the customer is to be satisfied.

Mr. H. A. Denman, Detroit, cited the satisfactory use of a 100-lb. steam line to meet the high pressure requirements in the business district. Office building owners are usually willing to allow a rental valve to the space occupied by a local plant. A high pressure line means costly tunnel construction, however. It is wise to make an allowance for ventilation losses in figuring the heat losses in buildings of the hotel type. This sometimes runs as high as 40 per cent. By putting counters on pumps much can be learned. On account of condensation losses the pump consumption has to be multiplied by a factor of 1.67, for Mr. Denman's conditions. Tests show that this corrective factor runs from 1.13 to 3.3. The rate for steam is about 46 cents per 1000 lb.

Mr. Arthur Williams, of New York, voiced the need of competent steam engineers in this class of work, who can tell what it will cost the company to operate the steam service if necessary. The owner's engineers will inevitably try to go beneath the central station cost estimate, on account of self-interest. There is a great variation in the heat leakage around windows. The use of weather strips is a valuable point to note. To obtain roughly the boiler capacity necessary for steam heating a rule is to allow 100 hp in boilers for each 1,000,000 cu. ft. of building contents. This means a fair average coal use of 4 lb. per boiler hp-hour three-fifths of the time during the heating period. Perhaps the best offhand rule is to allow from 30 to 45 cents per 1,000 cu. ft. of contents for each heating month in the year. Mr. Williams cited an estimated saving of from $5,000 to $10,000 per year by the application of Edison service to a hotel where the steam for the lighting service had to be thrown away all the year through. This hotel uses about 800,000 kw-hours per year, and the rate would be about 3.5 cents. Tantalum lamps would be installed. Only 200 hp of the 800-hp boiler plant are needed for heating. Another plan for large service is to supply 6600-volt, three-phase current to consumers at $30 per year per 1 kw of maximum demand plus 1.5 cents for kw-hour. The customer in such a case would install his own translating apparatus.

Mr. J. C. Brooks, Philadelphia Electric Company, said that his organization does not make a flat steam heating rate per year, except for labor and maintenance. The consulting engineer and the architect naturally put the central station on the defensive; hence the central station must have facts based on actual experience, for successful business getting. Generalities are no longer accepted by prospective customers. If a company can deliver a heat, light and power proposal, the customer can often be approached to better advantage.

Mr. J. F. Gilchrist, of the Commonwealth Edison Company, Chicago, emphasized the importance of taking on steam heating at flat rates in large buildings in order to make business grow. It is well not to be too particular about the immediate profits in territory where there is a chance of large future business. He cited the taking of a large heating contract at a loss in Chicago in connection with a certain office building, but as a result several other important buildings have been secured for the company which might otherwise have been lost. In closing, Mr. Bushnell said that an excellent rough rule for estimating the cost of coal in a building to be heated on a central station contract is to allow $1 per year for each 1,000 sq. ft. of hot water service in the structure. In Chicago the reliability of coal deliveries by tunnel is a good talking point. The St. John steam heater is used in Chicago.

UNIFORM COMMERCIAL DEPARTMENT FORMS AND METHODS.

Mr. Clare N. Stannard, Denver Gas & Electric Company, presented a paper entitled "Advantages to be Derived from Uniform Department Forms and Methods," of which he was the editor, with the following as assistant editors: Messrs. Henry J. Gille, Minneapolis, Minn.; A. V. Wainwright, New York City; Douglas Burnett, Baltimore, Md.; E. N. Wrightington, Boston, Mass.; C. Willing Hare, Philadelphia, Pa.; E. J. Allegaert, Newark, N. J., and V. A. Henderson, Memphis, Tenn.

Following are the main points of this paper:

Advantages of Uniform Forms:

(a) Systematizing and standardizing forms, contracts, canvass books and rates.

(b) Making possible comparisons between the results secured by various companies.

(c) Solving the problem of keeping prospects classified, and following them up at the proper time.

Advantages of Uniform Methods in Securing

(a) Interior lighting, electric display advertising, and power.

(b) Popularizing the business, securing publicity through press agents, newspaper advertising, and personal letters.

(c) Mutually beneficial education for the consumer, the representatives and the company, through uniform representatives' meetings and the display and demonstration of electrical appliances.

(d) The services of an unexcelled board of commercial engineers.

Increased efficiency is the main object of uniformity. In order that a manager may get the best results from his plant he should be able to decide matters that come before him on the basis of his best judgment, but he will be more satisfied with his conclusion if he knows the results secured elsewhere and can make comparisons with conditions at his own plant. For comparisons it is necessary to have uniform or similar methods, and, it follows, uniform or similar forms. Systematic and careful study of conditions will produce settled opinion and give confidence in a certain policy. Concise and well-defined plans result in increased business, greater efficiency, less expense in operating, and, what is most important, greater satisfaction to consumers. The importance of the commercial de-

partment in cultivating a field of good-will on the part of customers cannot be denied, although until recent years this responsibility has not been given the proper weight.

It may perhaps be almost impossible for all forms to be absolutely uniform, but there is no question that a general uniformity would be most helpful. Forms, contract blanks, canvass books and all that pertains directly to the work of the salesman should be so designed, arranged and standardized that the consumer is not wrongly impressed through careless assembling or uncertain application of the information supplied to the salesman. Uniform contracts and applications give the best office records. This is particularly true if the same company has offices in operation in several large cities. Uniform forms and contracts appeal to people moving from one town to another. They are especially effective where there are two opposing companies, for in case of consolidation the records are easily combined, causing little expense or delay. Contracts should be terse, complete and binding, but, above all else, to the point. Canvass books should reflect thoroughness and exactness.

The rate controversy may result some day in uniform and standard methods of calculation. Electric light men strive to standardize their plants, distributing systems, metering systems, bookkeeping methods and systems of accounts, but they do not give a sufficient amount of detailed attention to the standardizing or uniformity of rates. It would seem advisable to have a more uniform policy as to the monthly minimum guarantee to be charged, the standard classes of service to be supplied, and as to whether it shall be on the basis of a long-hour schedule, a quantity schedule or a flat rate per kw-hour.

It is desirable to work out a system whereby general comparative results can be accomplished, classifying among other items the following: Number of residence-lighting consumers; number of contracts; residence lighting in watts; commercial lighting in watts; commercial power in watts; commercial elevator in watts; commercial sign and window lighting in watts; estimated revenue of residences, and estimated commercial lighting and the like.

One syndicate is reported to exchange daily statements between the sales departments of the various underlying companies; a plan which, if conditions be understood, adds materially to the effectiveness of the department of each company and promotes rivalry which otherwise would not be maintained.

If a uniform set of forms for the commercial department were adopted by any large number of member companies, comparative results would be available readily from year to year. Such data should cover information as to how many solicitors to employ per 1000 of population for different sizes of cities and towns, bearing in mind the necessity for specializing of electric power, electric signs and other branches of the business; and a manager would be able not only to analyze the results secured in any one company, but to say just what men should be employed, what their occupation should be, and how much business should be expected to come from the soliciting force.

A uniform card-index system, keeping classified accounts of all prospects, could contain the following information: Name. Business. Owner. Owner's address. Light used inside. Light used in windows. Is electric sign used? Kind of power used. Are premises wired? Is any heating apparatus used? Date for future call.

There should be a uniform method of developing business by education. At present this work is done largely by representatives and, if some plan could be worked out whereby the desire for service would be created by methods that would attract, great results would be accomplished. Interior lighting is perhaps one of the most interesting and perplexing problems, and some uniform lighting system should, if possible, be worked out. Concentration of effort upon a given scheme of lighting brings confidence and enthusiasm to the salesman and gives it an advertising value, and becomes a talking point with the consumer. There are so many beautiful signs now to be purchased that it is indeed almost impossible for the up-to-date merchant to withstand the temptation of indulging in this most important branch of advertising, which need not be necessarily expensive. Are there not uniform ways of going after this class of business?

The electric power branch of the business requires constant and persistent work. The salesman's efforts could be reinforced by a vigorous advertising campaign. The press agent in a company or syndicate sufficiently large to warrant the expense accomplishes good by a logical and well-outlined plan of presenting the business conditions to the public, and in explaining the company's desires and aims. A campaign of education through the newspapers or other channels reflecting the attitude of the company does great good to the company, if it takes the position of plain-spoken truthfulness.

Representatives of the companies should meet together daily, or at least once a week, to keep in touch with what is going on. Much good has resulted from electrical shows and public demonstrations of all kinds. If it were possible for the association to have an organized electrical show, to be held periodically at central points throughout the country, it would be of great assistance in educating the public in the use of current-consuming devices and popularizing the business; although local shows in towns and in department stores and offices of the company have accomplished good results, if something could be worked out along this line it would give the business great impetus.

A board of National Electric Light Association commercial engineers would be beneficial to all central-station companies. Realizing that many individual companies could not afford a similar board, it is suggested that the board be sustained by the association.

COMPILATION OF LOAD FACTORS.

In a paper with the above title, Mr. E. W. Lloyd gives data relating to the load factor of different industries. It is stated that in one case out of 2900 consumers of power, with an installation aggregating 35,000 hp, the average maximum load was 53.5 per cent of the connected motor load. When reclassified on the basis of one motor, two motors, three to five motors and six to ten motors to the installation, the ratio of maximum to connected horse-power was respectively 73, 63, 64 and 50 per cent. A table is also given showing the results of an analysis of the load-factors of over 50,000 consumers of electric light, taken from actual reading of meters. In these cases the term load-factor is applied to the ratio of the average to the maximum load. The table also gives the ratio of the maximum to the connected load. Another table gives the load factors found to obtain in different kinds of manufacturing businesses, the factors applying to plants operating normally 54 hours a week. It is stated that if a central station were able to secure all of the business in a given city, the diversity factor of all customers would be such that the load factor on the station would probably be in the neighborhood of 50 per cent; as in some of the best central stations it is at present in the neighborhood of 40 per cent, some may question the possibility of raising this condition to 50 per cent, but it may be reasonably hoped that in the future the load factor will be considerably better as more business is secured. To increase the load factor above 50 per cent, central stations should encourage the making of by-products from electrical energy, such as ice and nitrates. It is suggested that the association should collect the load factors of different industries. In conclusion, the author points out that there is a difference of opinion as to the exact meaning of the word "load factor," which term he considers ought to be more clearly defined.

ELECTRIC POWER.

A paper with the above title was presented by Mr. Henry J. Gille, as editor, who was assisted in the preparation by Messrs. L. B. Buchanan, Jas. E. Davidson, Thos. M. Gibbes, F. H. Golding, G. K. Hutchins, E. W. Lloyd, R. A. MacGregor and Norman T. Wilcox. A valuable feature of the report consists of almost a score of curve sheets showing the motor load at various hours of the day of a large number of manufacturing plants. For comparison in each case the station load curve is given, in order to show the relation at any hour between the demand for power and the total station load. The subject of

power loads is discussed under the heads of (1) the extent to which such loads overlap the peak; (2) the use of curve-drawing instruments; (3) the advantages of obtaining power load off the peak; (4) the use of electricity in the manufacture of nitrates or other products using large amounts of power off the peak. The various curves above referred to are used in discussing the relation of the power load to the station peak. The conclusion is that a considerable portion of power business does not come on at the time of the peak, but that a considerable improvement could be made by arranging with many companies for the operation of heavy machinery, used only such a short time each day, in the forenoon or early afternoon. Another suggestion is to get power users to reduce the noon shut-down from one hour to 30 minutes, and to shut down a half-hour earlier in the afternoon. In considering the use of curve-drawing instruments, which, it is stated, broadly cover maximum-demand indicators, reference is made to the considerable difference of opinion regarding the length of time average demand should be taken as a basis of charge. In some cases the rated capacities of motors are used as a basis, but the committee believes that some standard should be established, and recommends that the association appoint a committee to consider this subject. The subject of the use of central-station power in the manufacture of nitrates or other products using large amounts of power off the peak is discussed under the heads of cost of power; location with reference to raw materials and market for products; permanence and continuity of power and its output from a given investment. It is stated that in this country manufacturers using electric power in chemical- or electric-furnace processes pay from $10 to $25 per kw-year, on the basis of 354 days of 24 hours to the year. Some of the processes in question require continuous operation, while others could be operated intermittently. Among the latter are the manufacture of artificial emery, calcium carbide, carborundum, graphite, ferro-silicon and similar alloys, oxides of nitrogen and nitrates, and cyanamide. Other classes of processes that could be adopted for intermittent operation are the electrolytic refining of copper, recovery of tin from scrap and the manufacture of oxygen. Some of the above-mentioned processes are referred to in detail in the report. The conclusion reached is that if power companies can supply energy off the peak for 20 hours or more per day at a price below $10 per kilowatt per year, they should be able to dispose of energy for conducting some of the processes mentioned. Evidently, however, the information secured by the committee did not encourage the formulation of any specific recommendations.

GROUP VERSUS INDIVIDUAL DRIVE.

Mr. C. A. Graves, in a paper entitled "Advantage of Group or Individual Drive in Certain Installations," discusses conditions which determine whether the group or individual drive is preferable. The factors which determine the type of drive are given as follows: Installation cost; price of current; machine load factor; shaft friction; motor efficiency; maintenance; speed variation or uniformity; time to make change; floor space; character of work. Each of these factors is taken up and discussed separately. By load factor the author designates the ratio of the average number of hours the machine is run daily, to 10 hours. The conclusions of the paper are that each installation should be weighed individually, because the cost and relative value of the factors involved vary in different sections of the country and with the different requirements of a client. Considering economical operation only, the group-drive installation recommends itself when the shafting friction is low, rate for current low and machine load factor high. The individual motor drive shows a larger saving with a high rate for current, high shafting friction and low machine load factor, and also shows an increased output when used within its field.

Discussion.

The papers by Messrs. Lloyd, Gille and Graves were discussed simutaneously. Mr. Lloyd emphasized the definition of load factors as the quotient of average load divided by the maximum load. In reading his paper Mr. Gille said that the committee is in possession of about 100 typical load curves of different industries, which could not be printed on account of lack of space. Mr. H. W. Peck, Rochester, discussed the principles which apply to the installation of motors in industrial establishments, considering the details of shafting arrangement, necessity of rugged equipment for the average customer and the advantage arising from the equal reliability of the high-speed and the slow-speed type of induction motors. Many valuable papers on belting have been published in the proceedings of the American Society of Mechanical Engineers. In general, central stations must obtain their own motor data, as not one prospective customer in a thousand can supply necessary information. Further advantages of the individual drive are more light, less noise, less danger from accidental starting, simplicity of remote control and the ability to install the motor anywhere on the wall or ceiling. Mr. E. W. Penrose, Tyrone, Pa., urged the value of off-peak consumption as a central-station by-product. In one plant the coal consumption was reduced from 10.5 lb. to 4.5 lb. per kw-hour in one year by the cultivation of off-peak business. Analysis shows, however, that there is danger of laying too much stress upon having power consumers stop work at 4:30 p. m. Mr. H. C. Alvord, Long Island City, said that in no case of his experience has there been a change back from the individual to the group drive. It is a good plan sometimes to speed up a group drive by raising the voltage. In one case a gas-engine drive in a textile mill was replaced by an electric-motor installation and the output was increased by raising the speed through an elevation of the voltage. This could not be done by the less uniformly rotating gas engine. In the main the individual drive is strongest where direct current is available and the group drive often requires changing the location of the machine.

Discussing Mr. Lloyd's paper Mr. Samuel Insull, Chicago, emphasized the high interest cost per year in the average company, due to its poor load factors. A company with an output of 100,000 kw-hours per month may represent an investment of $500,000. Its city lighting, store and residence lighting and small power service may give an unfavorable load curve, but most of these places store city water and much is to be gained by pumping it electrically. The greatest consumption of water occurs during the part of the year when there is no lighting peak to speak of. It is an advantage to supply power to interurban railways also, since these exert their maximum demand in the middle of the summer. If such a plant has a load factor of 30 per cent under present conditions it may be raised to a possible 40 per cent by the assumption of the above load. This means 33 1/3 per cent more output over which to spread the fixed charges. The effect on the station costs is so beneficial that a company can take these contracts at a rate which would have been out of the question under the old conditions; further, the investment for the pumping service of the interurban line may be but $200 per kilowatt as against $600 to $700 per kilowatt of house lighting. If the income of a company earning $75,000 per year can be raised to $100,000 by aggressive work, and if $10,000 of the increase can be saved, there will be a gain of 2 per cent in the dividends, and this may make all the difference between a profitable and an unsatisfactory company. By a little discrimination one can choose classes of business which cannot affect the station at the peak time, and then a few large manufacturing establishments in one's locality may be approached with confidence. Mr. E. F. McCabe, Lewistown, Pa., said that his company had an output of 1,250,000 kw-hours per year and a load factor of 44 per cent, which was brought about by cultivation of non-peak loads. He cited silk-sewing mills as excellent loads, since the majority of them run 24 hours per day and do not close during the noon hour. Mr. Harold Almert, Chicago, cited an increase of 14 per cent in load factor in connection with a power gain of 141 per cent and a 65 per cent increase in station output. Mr. Myers, Philadelphia, emphasized the importance of standardizing the load factor definition.

DEVELOPMENT OF CENTRAL-STATION REVENUE.

Mr. Theo. I. Jones, in a paper entitled "Development of Revenue from Existing Customers," presented a number of

methods to be pursued in increasing a company's yearly output without involving any material extensions to the company's system. Several forms of reports for use in this connection are reproduced in the paper. The subject is treated under the heads of rates, publicity methods and results obtained by the author in this line of work. In developing revenue from customers whose rate will not be lowered by increased consumption, the central-station representative must rely solely upon his ability to show the advantages from increased illumination or from the use of electric heating or power appliances without regard to the question of rate. In cases where additional consumption will result in a lower rate, a form of contract should be offered which seems best suited to each individual need; but if after a reasonable period of service the consumption indicates a better rate, a corresponding form of contract should be substituted, having the date of the original contract. Trial propositions are considered with favor, as it is the experience of the author that in 75 per cent of the cases where such propositions have been judiciously made the apparatus remained.

Referring to irons sent out on trial without previous solicitation, 88 per cent were retained. In this manner 200 irons have recently been delivered, and the records show that each gives an income of 70 cents per customer per month. A system of "development and inspection" is described, according to which each agent is given a stated territory over which he is supreme, and is required to write at the end of each day a report giving a full statement of the daily work done. In planning out this work, the customers whose bills average high per month are taken first, and as soon as these have been canvassed those giving less revenue will be taken up. The inspector calls on a customer with a view to obtaining his comments upon the service, explaining that he comes from the lighting company with a view to ascertaining the character of the service, whether it can be improved or not, and to receive any comments which the consumer may feel disposed to make concerning his service. In examining the installation any comments made by the customer are noted, and if any complaints are included the latter are later investigated. After the complaints, if any, are satisfied another call is made to ascertain the customer's view of the service at that time, when the agent has an opportunity to point out where additional service will be desirable, etc., etc. In the course of a week or 10 days a third call is made, and by this time the customer is ready to tell whether or not any of the recommendations as made by the agent will be accepted. As a rule some of the recommendations of the agent are usually accepted. If in calling the consumer has no complaint whatever to make as to service, the agent takes up at once the matter of recommendations and but two calls are then necessary. The paper includes a number of instances showing the benefit that has been derived from this plan of work.

Discussion.

Mr. H. J. Gille, of Minneapolis, thought that more might be done in the future in co-operation with manufacturers of electrical appliances by having the manufacturers send their advertising matter direct to central-station customers. In regard to the introduction of electric irons, his company had tried a plan, which worked very well, of having the meter man when he sets a meter for a new customer, or for one who has moved, ask the customer whether she has an electric iron. If she has not, he suggests that the company send one on trial, and that it is only necessary to sign the application card which he presents in order to get one. Almost invariably this results in a trial order. Mr. Joseph F. Becker, of Brooklyn, said the ambition of the solicitor is likely to be in the direction of an increase of the connected load, rather than an increase of consumption from existing consumers. To overcome this tendency the soliciting force of the city was divided into two divisions, and there was a chief over each division. One division of solicitors devotes its attention entirely to the increased use of electricity by existing customers. There are many customers using gas in part, both for lighting and power. Mr. C. N. Stannard, of Denver, said that after the conduct of a long campaign to increase the revenue from existing consumers, he was surprised at a recent morning meeting of the solicitors to have enumerated over 20 ways in which the revenue ot the supposedly perfectly or completely equipped consumer might be increased. Some of these items were that switches or sockets are out of order so that lamps could not be used; fuses out; lamps burned out and sockets empty; increased candle-power of existing lamps; replacing of oil decorative lamps by electric.

Mr. M. C. Osborne, of Spokane, Wash., stated that his company had distributed electric flatirons as newspaper premiums. These were sold at cost to the papers. The papers made a great feature of the offering of the electric flatirons to their subscribers and advertised the feature lavishly, much more so than the central-station company would be apt to do if buying the space. Mr. Osborne's company found this a satisfactory way of introducing the irons. Mr. Joseph A. Sutton, Baltimore, Md., spoke of the advantages of keeping electric appliances before the public by the use of company signs changed weekly. Mr. E. F. McCabe, Lewistown, Pa., said that his station renews the heating elements of irons, and Mr. Douglas Burgett explained how irons are employed to satisfy customers.

INTRODUCING TUNGSTEN LAMPS.

"Methods of Introducing Tungsten Lamps and Their Effect on Central-Station Income" was the title of a paper prepared by Mr. W. H. Atkins, as editor, and the following gentlemen as assistant editors: Messrs. R. F. Bonsall, G. S. Cartwright, H. W. Chase, A. A. Dion, J. W. Hancock, O. R. Hogue, Joseph D. Israel, George B. Johnson, George H. Jones, E. A. Mills, C. F. Oehlmann, M. C. Osborne and R. W. Rollins. The subject was considered under the heads of different policies pursued; methods of introduction and renewal; use of large units in competition with gas arcs; the effect of the introduction of tungsten lamps on the income. Forty questions were sent out to members of the association, and such replies as were received are epitomized. The bulk of the paper consists of a number of reports in detail, principally from large central stations, giving their experience with the introduction of tungsten lamps. Several of these reports from the larger central stations are accompanied by illustrations and forms. In the introduction of the paper the action is criticised of those companies who have kept the tungsten lamp more or less in the background for fear that its adoption would mean a reduction in income. This fear is said to be a mistaken one, as is fully proved by the experience of those companies that have pursued an opposite course and welcomed the tungsten lamp. It is recommended that one of the best policies for central stations in introducing the tungsten lamp is to make a special effort to increase the lighting of buildings which are now wired, but not sufficiently illuminated.

The answers to queries indicate that many policies have been followed by the different companies, as stated below in the order of their importance: The introduction is encouraged in every possible way for all classes of business; used to displace gas, gasoline or kerosene lighting; recommended to customers complaining of high bills; installed on all original work in business districts. As to methods of introduction and renewals, these have generally been the same, differing only slightly in detail, comprising newspaper advertising, circular letters to customers and prospects; personal effort of solicitors; demonstrations of the lamp, both in exhibition-rooms and on the customer's premises. Some of the larger companies have established an illuminating engineering department, including competent men to furnish detailed specifications in the most effective manner to customers contemplating the use or substitution of the tungsten lamp. The universal policy has been to charge for lamps at cost or at a slight advance in cost, except where a maintenance contract is entered into; exception is also made in the case of the companies which furnished free carbon-lamp renewals, which companies make an allowance to the customer of the cost of the carbon lamp when he purchases the tungsten lamp. It is stated that no very definite or satisfactory information was obtained with respect to the use of the 250-watt tungsten unit, and that the consensus of opinion favors the use of the 100-watt size. Replies indicate an unanimous opinion that the central-station income is not adversely affected by the intro-

duction of the tungsten lamp, and, furthermore, that it is likely to be increased in the future when the benefits of the lamp are more generally known, accepted and appreciated, and that through this medium the standard of illumination will be greatly increased, with the result that electricity will be much more generally used. Reports in detail on the introduction of tungsten lamps are printed from the following cities: Boston, Chicago, Philadelphia, Baltimore, Hartford, Ottawa, Dayton, Spokane, Richmond, Va., and Montpelier, Vt.

Discussion.

Mr. M. S. Seelman told of the methods in handling tungsten lamps in Brooklyn. The Tungsten Lamp Specialty Company was organized independently of the central station, and the solicitors of the Specialty company went after business among consumers using gas. Business thus secured was turned over to local contractors. A standard price for wiring in molding was established at $2 per outlet. Eight to 10 solicitors were employed. No consumers were solicited except by instructions from the Edison company. At the beginning it was announced to the Edison company consumers that the tungsten lamp was available in limited quantities, but it was not pushed among such customers unless they were dissatisfied.

Mr. J. T. Hutchings, of Rochester, N. Y., expressed the opinion that where the tungsten lamp had been a benefit to the central station it was where the central station had "pushed the lamp" instead of being "pushed by the lamp." He preferred single lamps scattered over the ceiling to clusters, as yielding better revenue and giving better satisfaction. Where lamps are maintained by contract, inspection is made once a week and lamps and reflectors are washed once in four weeks.

Mr. Douglass Burnett, of Baltimore, had found that the central station must control the tungsten-lamp output. He had found that contractors if left alone would use the lamp to lower the wattage of existing installations. Carbon-filament lamps are now rare on Baltimore business streets. The same price is charged for the 25-watt and 40-watt sizes, which encourages the use of the larger size. Mr. H. W. Hillman, of Grand Rapids, Mich., recently had the candle-power of gas and electric lamps on the principal business streets counted in Grand Rapids (which is reputed to be quite a gas town). This figured out in the ratio of 680 electric and 28 gas.

Mr. Joseph D. Israel, of Philadelphia, spoke strongly in favor of using the tungsten lamp and illuminating engineering to economize for the consumer where it seemed best rather than to think always of keeping up the wattage of an installation. He favored making trial installations where necessary and best. Mr. F. M. Tait, of Dayton, Ohio, expressed the desire for an early supply of the new 150-watt tungsten lamps, the idea being that one of these lamps could be substituted for a gas arc where there is an electric outlet at each gas arc. Mr. R. M. Searle, of Rochester, N. Y., said that the consumer usually wants better service and better light, and is willing to pay for them if he gets them.

INTENSIVE METHODS OF BUSINESS DEVELOPMENT.

In a paper with the above title Mr. John C. Parker gave an account of one of the methods pursued by the Rochester Railway & Light Company in extending its business. Two years ago the company had but one man to take care of industrial applications, whereas it has now, in conjunction with its commercial department, a staff consisting of a head and seven thoroughly trained engineers. All of the men are college graduates, and with but one exception have had shop experience. Among the duties of the staff are to make studies of the customer's or prospective customer's processes of manufacturing in order that electric power may be applied to the greatest advantage. In a case where a customer is sceptical of the company's judgment or dubious concerning such an unique business attitude, the equipment is put in on approval, to be paid for at the end of a fair test period if it has proven satisfactory, and in every such case the outcome has been excellent. The problems encountered involved a great deal in the way of study of boiler efficiency and the efficiency of steam-driven apparatus in already existing plants, mechanical drive, etc., and for this reason emphasis is given to the mechanical features of the work. It is often necessary to decide between various types of gears and belted drive, and to undertake special designs in gearing, and in other cases it has even been found necessary to build motors into existing machines as an integral part of the unit. The paper gives a number of illustrations of the different classes of work handled by the station. At present it is handling over 80 different processes, some of them very large and complex, and involving a great amount of detail. A feature of the organization is that all members are encouraged to undertake correspondence over their own signatures and to appear personally before their prospective customers. The result is that the customer cultivates the habit of thinking of one certain man in connection with his work and of dealing with this man and looking to him for assistance in all sorts of problems. In conclusion the author suggested that the association might with benefit devise some means for collecting engineering data of the kind needed for meeting competition, which would be placed at the disposal of its members, and he recommended that a committee of the association should be formed to collect such information and disseminate it. The need of such data, he believed, is one of the most urgent necessities at the present time, and this is especially true in regard to reliable data in connection with gas and gasolene plants.

Discussion.

Mr. E. W. Lloyd, of Chicago, endorsed the idea of having bureaus of specialists in the various branches not only in power and the economical use of power, but in illuminating engineering, heating, etc. He believes in having an engineering corps for the study of these various problems. As it is not always easy to exchange information of value in the ordinary course of business during the day, it is a good plan to have clubs for meeting and the exchange of such information. Mr. Graves, of Brooklyn, told how the Brooklyn Edison Company had developed specialists in various lines, he suggested that information taken from various power tests might well be exchanged by central-station companies, and he thought that there should be a permanent solicitors' handbook committee to facilitate such exchange.

Mr. H. W. Hillman, of Grand Rapids, Mich., reported having connected 1339 motors of an aggregate of 17,025 hp or 1 hp to six of population. A printed list of motor installations both encourages solicitors and helps persuade prospective consumers. He urged the installation of curve-drawing watt-hour meters on large power consumers, as they tell the central-station company many things as to the character of the demand as well as helping the consumer to stop leaks in the operation of his plant. He gave several examples of this. In one case the manager found his machines were not being used within a half hour of opening or closing time; in another case the night watchman was unnecessarily using an electric elevator. Mr. R. M. Searle, of Rochester, N. Y., gave some very interesting figures on the cost of conducting the contract department. This had cost for the past year $38,000, had closed $100,000 worth of new business and had held $20,000 worth of business which might otherwise have been lost. Mr. George N. Tidd, of Philadelphia, regarding the suggestion that figures on power installations be exchanged, said that he would be glad to furnish the information obtainable from the considerable number of central stations controlled by his company.

In closing the discussion, Mr. Parker, of Rochester, said that barring the possibility of mistakes in calculations there could be no uncertainty about putting in trial installations of motors, if the job were carefully figured out in advance. A company should have nerve enough to guarantee an installation after figuring it out. He believes in placing curve-drawing watt meters on all installations.

ELECTRIC VEHICLES AND CENTRAL-STATION BUSINESS.

Mr. James T. Hutchings, of Rochester, presented a paper entitled "Relation of Electric Vehicles to Central-Station Business," in which he detailed the experience of the Rochester Railway & Light Company in developing an electric vehicle storage-battery load. In the summer of 1906 the company sup-

plied 98 private and eight public charging stations, which figures had increased in December, 1907, to 140 and 14, respectively, with an increase in income of 59 per cent. The company has a department which gives the subject of electric vehicles special attention, and is in charge of a competent engineer of wide experience. Experience has shown that a low rate is not the greatest incentive to an increase in business, and it is apt to induce carelessness on the part of the customer as to the manner of use of the storage battery. What is most needed is a campaign of education, which shall increase the customer's knowledge of the proper methods to be pursued in charging his battery and handling his vehicle; it should be brought home to him that if the vehicle in operation uses twice the amount of current that is actually necessary to do the work, owing to friction, bad alignment and the like, not only is the performance of the vehicle decreased by more than 50 per cent, but the life of the battery is also shortened by more than that amount. Careful attention to minute details makes the success of the electric vehicle possible, and if these details are followed up there is no competitor of the electric vehicle in its own particular field.

The central-station manager is advised to take the electric vehicle situation seriously, and to give it the same attention as is given the sale of electric power, display lighting and heating appliances. If he does so he will find the electric vehicle a better medium for the sale of his product than anything that has previously been brought to his attention.

Discussion.

Mr. Day Baker, of the General Vehicle Company, Boston, said that the average central-station man has previously thought the electric vehicle a failure. The old-fashion, heavy equipments of a few years ago have been superseded by better apparatus, and men are now more generally educated to the proper operation of batteries. One prominent lighting company in the East had a three-ton electric machine for pulling cables. The battery was not charged regularly nor properly and the acid and voltage tests were infrequent. Two or three sets of plates were used per year, and the company was about to give up the electric machine when a new man took charge of the private garage. He changed the system of charging and installed a new battery in February, 1908. The machine has been in service constantly, often hauling cables 20 hours per day, and is still in first-class condition, with six months' wear of the plates remaining. The Anhaeuser-Busch Brewing Company, of St. Louis, has 52 electric trucks, which save 50 per cent of the previous cost of operation by horse, and none of these vehicles is of the latest economical type. A table was then presented showing that in two representative vehicles of the old and new design the cost of operation per mile for energy has been reduced from 3.6 cents to 1.1 cents, the latter being the lowest cost per mile ever obtained in a 1000-lb. vehicle. This table has been previously printed in the *Electrical World*. Mr. Frank J. Stone, of the Electric Storage Battery Company, Boston, advised the creation of a separate department in the central station for the handling of electric vehicle business. An incidental advantage is the picking up of considerable outside business by the solicitors while engaged in electric vehicle work proper. Mr. Newman, of the Woods Motor Vehicle Company, stated that "new brains" are the important part of the recent advance in electric vehicles. His company has found it necessary to open an operating inspection department to educate the central-station manager as to the causes of vehicle troubles. The kind of tire used, for example, affects the power consumption of the machine. This department now has a machine for measuring the internal feature in tires in terms of watts consumed per revolution, and is prepared to assist the central-station man in the determination of technical problems with the object of reducing maintenance cost. Charging rates should be made as low as possible, and too much emphasis cannot be laid upon the importance of proper charging of batteries. Mr. C. D. Hibler, Rochester, N. Y., said that in his experience batteries are destroyed by overcharging rather than by the service of the machines on the road. Mr. W. P. Kennedy, consulting engineer of the Studebaker Company, New York, called attention to the new magazine, *The Electric Vehicle and Central Station*, published in New England for the purpose of stimulating this branch of the industry. Mr. F. J. Stone corroborated Mr. Hibler on the effects of overcharging, and Mr. Samuel Scovill, of Cleveland, outlined the electric vehicle situation in that city. There are about 1500 machines in service at present. The mercury-arc rectifier is eliminating overcharging to a considerable extent. It is a disadvantage for the central station to attempt to do much repair work on electric automobiles. Mr. Rice, of Indianapolis, urged co-operation of the central-station interests with the manufacturers of batteries and vehicles and touched upon the advantage of the electric carriage as an off-peak load. Mr. M. E. Turner, of Cleveland, said that the average income from 338 charging stations, where the current is measured at the lighting meter, is $60 per station per year. Mr. J. H. Vail, of the General Vehicle Company, New York, presented a vast array of figures showing the enormous estimated cost of maintaining horses and mules in the streets of America. He estimated that the central stations of the country would secure an added annual revenue of $108,000,000 by displacing the horse. The cost of living is increased 10 cents per capita per day by the presence of the horse in the streets of a city like New York. The electric automobile will do twice the work of a two-horse team. A number of cases showing the actual saving of the electric vehicle over horse traction were also presented. Mr. T. Commerford Martin, editor of the *Electrical World*, stated that he had sent 4500 circulars of inquiry bearing upon the electric vehicle situation to all of the central stations of the country. Already 1400 replies had been received; 218 stations are already directly interested in this work, 234 furnished general data bearing upon the situation, and a large number of others are thoroughly aroused to its importance. The question of rates is a most vital part of the discussion of electric vehicles. A new era of transportation is at hand. In 1886 the speaker read a paper on electric vehicles before the 20 companies who comprised this association, and in the next year he read the first paper in this country upon the motor in electric traction before the 13 street railways comprising the American Street Railway Association. To-day there are 5000 central stations and 1300 electric railway systems in this country, and it is apparent that the future of electric vehicle transportation is equally bright. Mr. F. M. Tait, Dayton, Ohio, concluded the session by urging central stations to pay more attention to the electric vehicle business. Even where these machines are used to considerable extent there are only three in service for 1000 inhabitants. It is bound to be a paying business.

ELECTRICITY FOR NATIONAL ADVERTISING.

In a paper with the above title, Mr. George Williams sets forth the merits of the electric sign under 10 different heads, and in conclusion suggests that the association should collect the following information from Class A members and compile the same for the benefit of members, national advertisers, advertising agencies and sign builders: (a) List of available local roof locations, with their descriptions and terms of rental. (b) Flat rate of service for 4-cp per night of six-hour and 12-hour night burning. (c) Expense of lamp renewal and sign cleaning. (d) Names and brands of products already advertised by electric display, accompanied by photographs.

Discussion.

Mr. T. I. Jones, of New York, commented on the fact that the paper of Mr. Williams dealt only with the electric signs having letters made up of exposed lamps, the inference being that this class of sign business is the only kind to be cultivated on a large scale. In New York City he said that illuminated billboard signs had proved very successful and popular among advertisers and a good source of revenue. These usually are illuminated by tungsten lamps with reflectors to conceal the lamps. Mr. H. J. Gille, of Minneapolis, thought that the members of the N. E. L. A. should co-operate with the National Posting Association, as the members of the posting association are the ones who are naturally most closely in touch with this kind of

work, and have the appropriations for advertising. Mr. W. H. Gardiner, of New York, told of the very remarkable building being erected on Broadway in New York. The first six stories of this building are like an ordinary office building, the remaining 14 stories will have a steel-frame construction, but instead of being used for offices will be used entirely to support electric signs. Mr. Henry Ives Cobb is architect for this building. It is figured that the rentals from the building as a sign space will be larger than it would be if rented for offices. Mr. C. N. Stannard, of Denver, endorsed what Mr. Gille had said about the desirability of getting in touch with the National Posting Association. He said that through two of the local representatives of this association in Denver his company had received orders for a number of electric signs. Mr. Frank M. Tait, of Dayton, told of some of his troubles in getting national advertisers to consider favorably electric advertising in towns of less than 100,000 population. The tendency seems to be to seek large centers, although he was convinced that in a city like Dayton, with its interurban railway facilities, electric advertising would be a very good proposition for the advertisers.

PRACTICAL ILLUMINATING ENGINEERING.

In a paper entitled "Practical Illuminating Engineering in Connection with a Commercial Department," Mr. G. A. Sawin gave the details of central-station illuminating engineering organization. The illuminating department should be a separate branch of the commercial or sales department, the engineer reporting to the chief commercial or sales agent. The department would consist of an illuminating engineer at the head, with sufficient engineers and inspectors to care for the business properly. The inspectors would visit customers who desired advice, learn their wishes and report to the illuminating department, where the engineer and assistants would lay out a lighting scheme which would be handed to the customer by the solicitor. The inspectors should preferably be trained solicitors, who combined illumination service with their other work. The paper gives details of the organization of such a department, with suggestions as to records and forms.

Discussion.

Mr. J. D. Israel, of Philadelphia, reviewed the work along this line by the Philadelphia Electric Company. Mr. F. E. Smith, of Boston, told of the commercial illuminating engineering division of his company started within the last year. It was based on the principle that one satisfied customer makes 10 new ones.

Mr. C. N. Stannard, of Denver, read a communication from Mr. C. F. Oehlmann, illuminating engineer of the Denver Gas & Electric Company, giving some suggestions as to the conduct of such a department. He thought that lamp exchanges and sales if made by the company should be reported through the illuminating engineering department so as to keep track of what the consumers are doing as to lamps. He also recommended that the company carry a stock of globes and shades, as these are almost to be considered a part of the lamp in modern practice. All salesmen should be trained in illuminating engineering.

ELECTRIC HEATING FOR INDUSTRIAL PURPOSES.

A paper entitled "The Adoption of Electric Heat for Industrial Purposes" was submitted by Mr. Charles J. Russell, as editor, who was assisted in the preparation of the paper by Messrs. James I. Ayer, E. R. Davenport, Frank H. Gale, W. S. Hadaway, Jr., Joseph D. Israel, George B. Johnson, G. M. Kebbe, C. K. Nichols, LaRue Vredenburgh and R. R. Young. The heads of the paper are as follows: Present status; supply of data; the field; rational development; heating units; existing applications; metal trades; printing and publishing trades; leather trade; wood-working establishments; celluloid industry; cloth and textile trades; laundries; paper industries; confectioners and bakers; automobile garages; branding devices; appliances for hospitals and surgeons; general. It is stated that at least 1000 distinct types of electric heating applications for various industrial purposes have been successfully made, and a conservative estimate would place at 300,000 kw the electrical capacity at present utilized in this country and Europe for electric heating purposes. Referring to electric furnace applications, it is stated that abroad several large central stations are furnishing electricity for the operation of electric furnaces. The load factor of this class of business is very high, and in some cases the amount of time and supply rests with the central station. The paper under the heads of the various industries gives much information as to the numerous applications of electric heat, together with data in many cases as to the consumption of electrical energy in various electric heating processes.

ISOLATED PLANTS.

The subject of isolated plants was treated in a paper prepared by Mr. R. S. Orr, of Pittsburgh, as editor, and Messrs. Paul H. Bate, F. B. Carter, T. I. Jones, R. B. Mateer, J. T. Maxwell, Joseph McKinley, R. C. Niles, Jr., and H. Spohrer as assistant editors. The text consists of an introduction of two pages and two papers prepared specially by Mr. F. B. Carter, of the Boston Edison Company, and Mr. J. T. Maxwell, of the Philadelphia Electric Company. Central stations are advised to make a thorough study of the isolated-plant situation and have on their staff an expert who understands the principles and best practice in the operation of steam engines and gas engines, who is familiar with the best methods of illumination and the latest and best practice in the application of power to machinery and who is able to marshal his facts and arguments with such clearness and force as to compel the acceptance of his conclusions. Lacking such an expert, good results can be obtained from the work of a carefully selected force of men, each with his specialty or specialties, who will be guided and directed in the work by a competent head. In any event, careful investigation, sustained effort and the application of common sense to every phase of the problem will bring good results, whether with one or with many men. The paper of Mr. Carter gives data and regulations that have been used by his company in combating isolated plants. Included is a tabulation for use in determining complete isolated-plant cost. The paper of Mr. Maxwell gives the organization of a department of the Philadelphia Electric Company which deals especially with the isolated-plant situation. Details are given, including forms, of the methods of conducting the department and its field work.

Discussion.

This paper was first discussed by Mr. Joseph McKinley, Pittsburgh, who said that the central station is weak in the possession of actual isolated plant operating cost data. Mr. H. W. Peck, Rochester, N. Y., confirmed this, and stated that many customers in Rochester are willing to pay from 10 to 20 per cent more for central station service than their own power costs, on account of the superior attractiveness of the latter. Mr. T. I. Jones, New York, emphasized the importance of studying the gas engine operated in the isolated plant from city mains. Mr. Lloyd, of Chicago, said that a rate of 4.5 cents per hw-hour is often sufficiently low to enable the company to displace such engines. Mr. Paul Mueller, Erie, Pa., cited the difficulties of trying to compete with natural gas of 1100 b.t.u. per cubic foot, costing 32 cents per 1,000 cu. ft. Mr. M. F. McAlpin, of New York said that the New York Edison Company has found the higher efficiency lamps very useful in displaying isolated plants. The economies obtained by the use of the 25-watt tantalum lamp in isolated plants which have been taken over have been very marked. Others who spoke along the same lines were Messrs. Morse, Johnson, Richter and Ehrlanger.

CENTRAL-STATION DISPLAY-ROOM.

A joint paper entitled "Can a Display-Room Be Conducted on a Profitable Basis?" was presented by Mr. Frank B. Rae, Jr., as editor, and Messrs. H. K. Mohr, D. W. Lloyd, John G. Leonard, George Williams and H. K. McConnell as assistant editors. The text of the paper, however, relates to the subject of a salesroom conducted for immediate profit. After discussing the arguments pro and con the conclusion is arrived at that there is evidence that a salesroom is not only a large city possibility, but is a small town necessity.

ELECTRICITY FOR DOMESTIC PURPOSES.

A paper entitled "Electricity for Domestic Purposes with Particular Reference to Electric Heating Appliances" was presented by Mr. Matthias E. Turner, as editor, who was assisted

in the preparation of the paper by Messrs. H. W. Hillman, C. Edgar Titzel and W. H. Wissing, as assistant editors. The principal subject discussed in the paper is electric cooking and its development. At present there are serious drawbacks to electric cooking apparatus—namely, lack of durability, slowness in heating and quantity of current required. The first-mentioned defect, it is stated, and most probably the second one, also, will soon disappear. The third defect has been partly overcome, and by a combination of an electric and steam cooker the current consumption may be reduced more than 50 per cent. It is stated that in Cleveland, where there are more than 40 complete cooking outfits used exclusively for providing the meals for as many families, the average cost of cooking for each person at 5 cents per kw-hour is $13.65 per year. The introduction of defective apparatus in the past, of which from 60 to 80 per cent was returned by customers, has made it more difficult to introduce the better appliances of to-day. Designs emanating from technical minds are criticized, and it is stated that central-station men are now determining the designs for apparatus from experience in its use, and the manufacturers are meeting this new condition. Where principles of design have not yet been fully agreed upon, and methods of manufacture are in an experimental stage, no satisfactory relations, it is stated, can be established between the consumer of current and the manufacturer except through the medium of a policy broader than immediate profit. Referring to the residence load, it is stated that this had received little attention up to a few years ago from central stations. At present it is realized, however, that to every 10 factories or 100 stores there are perhaps 1000 residences, and that the residence load will in time become an important part of the total business. With the increase of residence customers for electric light, a field for other uses of their electricity will then have been secured, and the use of electric heating and similar apparatus can be pushed as fast as the manufacturers provide them.

Discussion.

Mr. H. W. Hillman, Schenectady, stated that the electric heating business is now fully established. Flatirons are produced in lots of 100,000 at a time. He sketched the part that self-centered devices developed by the manufacturer have played in lowering the cost of operation, and referred enthusiastically to the work of Mr. A. C. Dunham in the electric cooking field at Hartford, Conn.

ADVERTISING IN SMALL TOWNS.

In a paper with the title "Novel Methods of Advertising in Small Towns" Mr. Alex. J. Campbell, as editor, and Messrs. J. W. Cartwright, Jr., Elizabeth C. Lewis, A. T. Lloyd, J. I. Matthias and J. S. Whitaker as assistant editors, give briefly the result of a canvass among central-station companies in small towns as to their advertising methods. A number of replies are quoted, which, however, do not indicate any special originality. The conclusions of the paper are that to get up something novel and original to attract attention is certainly an alluring idea, and makes the best sort of advertising provided—which is the important clause—that selling power is combined with the novelty. To attain this end is worthy a man's best efforts, but he should be clear-headed and not deceive himself into believing that he is doing successful advertising because he secures an audience or provokes a smile. In the opinion of the author, novel forms of advertising are usually short-lived. While they may attract attention for a day, they do not hammer home the vital facts nor are they able, as a rule, to embody the logic that carries conviction or the persuasion that creates a customer.

Accounting.

REPORT OF COMMITTEE ON UNIFORM ACCOUNTS.

The report of this committee was presented by the chairman, Mr. H. M. Edwards. The report contains a classification of construction and equipment accounts, giving the association a complete system of accounting, including both property and income accounts.

The committee renews its suggestion in the 1907 report that the association should develop its standards slowly, in order that it may have the benefit of the most modern practice, and leaves for future consideration the standardization of accounts embracing floating capital and liabilities, also departmental and subsidiary records.

The report then compares the New York Public Service Commission's system with that of the association.

The general accounts adopted by the commission follow the same lines as the association standard except that the distribution accounts are divided. The accounts covering the cost of bringing the service into customers' premises—including the setting of meters and converters—are grouped under distribution; and the accounts covering the cost in customers' premises—including first installation and renewal of incandescent lamps, trimming arc lamps and incidental repairs—are included in a new general account called utilization. There is the greatest variation in the practice of the different member companies in regard to what is supplied to consumers in connection with the electric current. It is a fact, also, that the legal obligation of an electric lighting company usually ends with the delivery of the current to the meter in customers' premises, and functions that the company assumes beyond the meter are voluntary and lie within the discretion of the company. For these reasons the accounting committee considers the division a good and logical one and recommends that the commission's plan of separating utilization accounts from distribution accounts be adopted and that the association's standard be amended to that extent.

The association standard included two general accounts—commercial expense and new business. The commission has one general account, commercial expense, with subdivisions to show the respective costs of each. In other respects the association and the commission have the same general accounts.

Four divisions of expense accounts are provided by the commission—one for companies with annual revenue of less than $25,000, one less than $100,000, one less than $500,000, and the fourth being the full classification. The companies which have adopted the association's standard will have a little fuller analysis than is contained in the first two divisions of the commission, and only slightly less analysis than the third division. The point of difference between the third division and the association standard is that maintenance-steam equipment is divided in the commission's plan into repairs to boilers and accessories and repairs to steam engines. There is also an account miscellaneous station repairs. The association's account for maintenance of transmission lines is divided by the commission into subway rent, maintenance-poles and fixtures, maintenance-underground conduits, and maintenance system repairs.

The association's schedule under general expense agrees exactly with the commission's system, except that the latter has added the following accounts: Relief department and pensions; franchise requirements; amortization; electric expense-transfer credit; joint operating expense credit; store and stable expense; undistributed adjustments; duplicate charges.

The accounting committee does not approve the separation of taxes and uncollectible bills from operating expenses, and their inclusion as part of the expenses of outside operations, holding that these items are a definite part of the cost of operation and that while they may not be within the control of the company, each constitutes one of the elements of cost.

The committee believes that the association's standard is preferable to the commission's scheme in the arrangement of the accounts included in production and distribution, which in the association standard provide for a total of the operating accounts and a total of the repair of maintenance accounts, the two totals then being combined into a grand total constituting the cost of the division. The commission's scheme lists all the accounts under one general caption and provides one total only.

The 1908 report of the committee presented figures showing that over 75 per cent of all the electric lighting companies had annual revenues of less than $15,000, and it was suggested that even the minimum classification might be too extended and

uneconomical for their use. The experience of the last year has confirmed this impression, and the committee therefore recommends that for the use of the smaller companies a classification be adopted consisting of the main divisions only, as follows: Production. Transmission. Distribution. Utilization. Commercial. New business. General.

In the classification of construction or fixed capital accounts the committee has assembled the accounts by broad divisions, so that those companies not requiring extended analysis of their construction expenditures may be guided in their condensation. Companies located in New York and Wisconsin will not be able to avail themselves of this option, as the commissions' systems require the same analysis for small as for large companies. The classification of construction and equipment accounts, as reported by the committee, is as follows:

Division	Subdivision
Organization	
Royalties, franchises and licenses	
Generating plant—Steam	Land
	Structure
	Boiler plant
	Prime movers
	Electrical plant
	Miscellaneous
Generating plant—Hydraulic	Land
	Structure
	Dams, canal and pipe lines
	Turbines and water-wheels
	Electrical plant
	Miscellaneous
Generating plant—Gas	Land
	Structure
	Gas producers and accessories
	Gas engines
	Electrical plant
	Miscellaneous
Underground conduits	
Pole and fixtures	
Transmission	Conductors—overhead, underground
	Land
	Structure
	Substation equipment
Storage batteries	
Distribution	Overhead conductors and devices
	Underground conductors
	Services
	Meters
	Line transformers
Arc and glower lamps	
Customers' installation	
Municipal street-lighting system	
General office and branches	Land
	Structure
	Furniture and fixtures
Other equipment	Land
	Structure
	Coal-storage equipment
	Shop equipment
	Storeroom equipment
	Stable equipment
	Laboratory equipment
	Tools and instruments
Miscellaneous—During construction	Engineering and superintendence
	Law expenditures
	Taxes
	Interest
	Injuries
	General

The committee has kept in touch with the situation in the various States so far as public service commissions were concerned, has procured copies of all State bills appointing public service commissions, and, wherever such bills have authorized the respective commissions to prescribe systems of accounts it has arranged to communicate with the local electric light association, tendering its services in any effort which might be made to bring about uniformity in the legislation of the various States in relation to electric light accounts. At the request of the Public Service Commission for the State of New York the committee has agreed to act in an advisory capacity to the commission in relation to questions which may arise under the classification of accounts as adopted, acting in this respect in conjunction with the Empire State Gas & Electric Association.

The report is signed by the following: Mr. H. M. Edwards, chairman; Mr. E. J. Allegaert, Mr. John L. Baily, Mr. E. L. Brundrett and Mr. F. L. Dame.

Discussion.

Chairman Edwards stated that several hundred copies of the classification of accounts adopted for public utilities by the Railroad Commission of Wisconsin had been received from Mr. W. J. Hagenah, statistician of the commission. This classification appealed to Mr. Edwards as a good working system of accounts. The decision of the committee to separate distribution and utilization expenses was a good and logical one because the legal obligation of the company usually ended with delivery at the consumer's meter and any work the company undertook beyond that point was voluntary and within its own discretion.

Mr. Charles R. Price, New Bedford, Mass., said that no one appreciated better than himself the desirability of a uniform system of accounting for comparative purposes. Companies found a great deal of good information and a great deal to guide them in their operations in the knowledge of what other companies were doing. Even in Massachusetts, however, it was found that the returns were not always uniform, because the information was not reached in the same way by each company.

Mr. C. N. Duffy, Milwaukee, Wis., expressed appreciation at the indorsement by Mr. Edwards of the Wisconsin classification. The commission judged the results of operations of the companies from the reports under the classification and based its conclusions as to rates thereon. The accounts would give an accurate and comprehensive basis of the cost of performing the various public utility services. Any company, large or small, ought to be able to use 63 primary operating expense accounts, the number provided for the smaller class in the Wisconsin classification. It was understood that if any company, however, could convince the commission that it was unable to do more than group the accounts, because of the excessive expense involved, no more would be required. The attitude of the commission had been broad and evidenced a desire to co-operate with the practical necessities of public utility corporate accounting. Since the classification had been printed several modifications and changes had been made, principally in terminology. The monthly reports of the Milwaukee Electric Railway & Light Company were exchanged regularly with the subsidiary properties of the North American Company in St. Louis, and the information presented was entirely satisfactory for the purposes of the technical and operating officials. Mr. Duffy regarded this as a strong compliment to the Wisconsin classification.

The report of the committee was then accepted by the accounting session on motion of Mr. G. W. Claflin, Boston. This action was reported by Chairman Edwards to the general session, which thereupon referred the report to the executive committee with power to act.

BRANCH-OFFICE ACCOUNTING.

Mr. E. J. Allegaert, auditor, Public Service Corporation of New Jersey, described in a paper with the above title the practices of a company with whose operations he was familiar. It supplies municipal street lighting and commercial lighting and power service to 133 municipalities, serving a population of 1,700,000 out of a total of 2,300,000 in the State, being 74 per cent. The organization includes a commercial department having charge of all relations with customers, and an operating department responsible for the production and distribution of the current. The territory is divided into six commercial and six operating divisions following the same territorial lines. Each commercial division is in charge of a "division agent," located at the most important city in the division. He reports to the general office. There are 23 commercial offices or districts, each in charge of a representative with title of "agent." The agent reports to his division agent. The district offices range in size from one serving 128 customers to the largest office serving 9737 customers. In the smallest office the force consists of the agent and a boy as assistant. Each operating division is in charge of a "division superintendent," who reports direct to the general office. There are 20 operating districts, each in charge of a local representative, who reports to the division superintendent. Each operating district covers the same territory as the commercial district, except that each of three operating districts is divided into two commercial districts.

To obtain the best results in branch-office accounting standardization of methods and practices are essential. The company has a uniform system of accounts and forms. To further

assist in this work, letters of instruction are issued by the general office from time to time and as necessity demands. These letters are addressed individually to each man in charge of a district. The company has a uniform lighting rate schedule, reducing from the base rate by steps and automatically, so to speak, giving an appropriate rate to the largest customer. It has a uniform power-rate schedule and a uniform rate schedule for municipal street lighting, arc and incandescent. It has a standard contract.

Each district office is a complete unit for the transaction of business with the customer, and the agent is authorized to execute contracts for supplying commercial light and power on the existing lines, reference to the general office not being necessary. Municipal street-lighting contracts are executed by the general officers of the company, but the business is secured by the agent or general agent.

Bills and the entry in the ledger are made out independently from the meter slips, the rule requiring a separate calculation. Comparison is then made, and delinquent balances shown on the ledgers are added to the bills. Bills are, generally speaking, delivered by collectors, and collections begin at once. Due to special requests, and for other reasons, a small proportion of the bills are mailed. The form of bill used has two coupons attached, one a cashier's coupon, the other a bookkeeper's coupon. Each day's cash receipts are deposited in the local bank in full on the morning following. The disbursements for the usual small expenses of conducting an office are not allowed to be made therefrom. A suitable amount of cash is advanced to each office as a petty cash fund from which small expenses are paid and deposits refunded. An attractive display of small appliances, irons and portables, is made at each office. Sales are made to customers, the accounting for which is taken care of by a system of sundry sales orders, sundry sales book for entering the charges, and sundry sales ledger. When business is offered that cannot be provided for on existing main lines, it is necessary to obtain the approval of the general office before the business can be accepted.

At the end of each month reports are made by the commercial offices to the accounting officer on the subject of "business," "cash receipts," "allowances," "sundry sales," "outstandings" and "new business." Each week there is forwarded from each office a report of solicitors. At the end of each calendar quarter a report of uncollectible bills is received from each office. The agent certifies that in his judgment the accounts listed are uncollectible, and recommends their transfer to a suspense ledger and asks for authorization to make the transfer. If approved, authorization is issued by the accounting officer, and the transfer of the accounts to the suspense ledger is equivalent to writing them off to the proper operating expense account. The traveling auditor is a very important factor in branch-office accounting. He reports direct to the accounting officer. His duties confine him to the field, and he visits each office as directed.

Each operating district is equipped to supply current either directly from a generating station or from a substation located in the district. Each operating district is also fully equipped to distribute the current to the customer involving the construction and maintenance of lines, the setting and removing of meters and transformers, the renewal of incandescent lamps, and the attention to trouble or complaint work. A supply of materials is kept at each point, all separately accounted for to the general office, and in charge of a storekeeper who reports to the local operating man. Complete meter, transformer, arc-lamp and other property records are maintained. Material is ordered by the local operating man by requisition, which is sent to the division superintendent for approval and transmission to the general office. Each district is also supplied with a local or emergency order form for ordering material, or work to be performed, from local dealers. This form of order is restricted to small hardware purchases, hay, feed, horse-shoeing and the like. Each local operating man is furnished with a petty cash fund for the payment of small cash expenses and for freight charges. All freight charges except freight on coal for generating stations are paid in cash at the time material is delivered.

Materials are entered on the receiving and bill record book when received and bills are checked therefrom, recorded therein and passed. A separate book is kept for coal received at generating stations. Coal freight bills are sent to the general office for payment by voucher check. Materials purchased in excess of the current needs and those for which the account to be charged cannot be determined at the time of purchase, are placed in general stores and are recorded in a stock ledger at cost prices. Materials are issued on storeroom requisitions approved by the local operating man. Accounts benefited are charged at the average or composite cost prices.

The local operating man in each district makes up his own payroll and forwards to the accounting officer for audit. A voucher check is prepared payable to the agent of the district, who acts as paymaster.

The auditor's charge notice is to cover a charge to be taken up on the general books against an individual or company for the return of goods, the sale of scrap or abandoned apparatus, and for any work performed other than that for customers. Goods returned to shippers are treated as a sale. The exchange of goods on the same bill or the same order is not permitted. Before a sale of scrap material takes place local operating men are required to obtain authorization.

The company ships materials from one district to another and the accounting therefor is by means of an interchange charge and bill, which taken together become in effect a journal entry.

At the end of each month reports are made to the accounting officer by the operating officers on the following subjects: "Station production and output," "substation output," "fuel," "general stores," "stable inventory," "stable hours," "condemned apparatus and material," and "cost of extensions of electric lines."

Discussion.

Mr. W. E. Freeman, New York, said it was the practice of the New York Edison Company to centralize the work of rendering bills in the main office. While there were branch offices for the collection of accounts, the customers' accounts were kept at the main office and this had been found to be economical. The branch offices also secured contracts. The Hollerith system was used for tabulating earnings. It was entirely practicable to make an analysis of earnings by territory and by classes of business. The classification by territory permitted a comparison from month to month of the readings by trips. If there was any apparent discrepancy in the earnings for a month the differences could be located readily by comparison with the readings for the preceding month or the corresponding month of the previous year.

Mr. Allegaert, in closing the discussion, said that he did not use the loose-leaf ledger, but had many features of the accounting work where the loose-leaf system was used.

CUSTOMERS' ACCOUNTS, INCLUDING THE HANDLING OF METERS IN THEIR FINANCIAL ASPECT.

Mr. L. M. Wallace, auditor, Edison Electric Illuminating Company, of Boston, in describing the system of that company in handling these accounts, said that it was exemplified by the word "centralization," the responsibility for the performance of the duties in this connection being under one control, the auditor. Meters are read on every working day in the month. The average maximum number of meters installed determines the number to be read; the total, being divided by the number of working days, establishes the average number to be read each day and this number is called the daily load. Each day's load has its own meter slips, loose-leaf system, arranged in the geographical or consecutive order of reading and bound in covers, one for the meter reader for each route. Meters are read in accordance with the daily loads as determined by the billing department, after which the head meter reader makes a cursory examination of the readings, as recorded by his force, for the purpose of detecting any abnormal change in consumption.

The meter-reading slips are then given to the billing department, when the calculators transfer the readings to the cus-

tomer's billing card. These cards then go to the bill clerks and, after the bills are made, to the earnings statistical division in the billing department, for record on the earnings journal sheet. The earnings journal is also the official record of the monthly gross earnings from the sale of electricity and total amount of bills rendered. Tabulating cards are punched corresponding with the information desired for statistical purposes, such information being supplied by means of the billing cards. At the close of each day's business the total amount of bills rendered (which is arrived at by means of the Burroughs adding and listing machine) and the amount of bills recorded on the earnings journal and the amount of earnings distributed to the different classes of income must agree with each other. This system permits of readily determining the total monthly gross earnings from the sale of electricity early in the following month, on the average by the third day. The completed bills are transmitted to the accounting department, where they are separated into groups corresponding to the number of ledgers in use. When the day's bills have been completed and compared by the ledger clerks, a junior clerk detaches the coupons by means of a regu- (No. 13 Pearl) lever paper cutter, capable of detaching approximately 350 coupons at one stroke of the lever. The customers' ledgers are of the loose-sheet, horizontal monthly balance form, eight in number. Ledger No. 8 is used solely for the purpose of handling discontinued account balances. The system followed in the collection of accounts is planned especially to handle the collection of bills that are rendered net. Loose collection sheets are used on which to record all payments made by customers.

The superintendent of collections personally interviews certain customers, whose accounts are large, when such attention seems necessary; the auditor likewise may give personal attention to certain accounts at certain times. When all of these efforts have proven unavailing, the account is turned over to the legal department for collection, and all that are thus handled are taken from the active ledger accounts and charged to the legal accounts receivable account, and there remain until a final disposition is made either by being collected or transferred to bad debt account. Personal effort and moral persuasion, coupled with diplomacy and gentlemanly demeanor, go a long way toward swelling the collections and at the some time not disturbing the otherwise friendly feeling the customer may have for the company. Collections promptly made are extremely essential, and it is the constant aim of the collection department to insist judiciously upon the prompt payment of bills.

Discussion.

Mr. F. L. Dame, New York, said that it had been very convenient in connection with collections in some places to use a cash register manufactured by the National Cash Register Company.

Mr. John H. Gulick, Chicago, said that the arrangement of the ledgers and the billing forms and the collections of the Chicago Edison Company were somewhat similar to those outlined by Mr. Wallace. The Hollerith system checked absolutely the extension of the bills, which were not checked by clerks at all.

Mr. Charles R. Price, New Bedford, Mass., said that all the bills in his company had coupons. Special collections and overdue accounts were given to two collectors, one for the north and one for the south end of the city, and these men followed the accounts that were in arrears.

Mr. H. R. Kern, Philadelphia, said that the bills were sent by the accounting department to the district managers for perusal and then forwarded to customers. Where cash discounts were allowed to consumers, the accounting department always questioned the action of the district managers in extending the time limit. Sometimes the district managers held bills for certain reasons. All accounting should be consolidated into one department.

Mr. E. H. Robinson, Schenectady, N. Y., had about 22,000 accounts and, since 1904, had used loose-leaf ledgers similar to those described by Mr. Wallace. The bills were made out on postal cards. If a customer is delinquent, a sheet was sent out in nine days and if the bill was not paid on the day following, it was handed to the collector. It had been found convenient to have the collector use a motor cycle. A few objections had been made by customers to the use of postal cards for bills, but when a balance from the previous month was unpaid the bill was always mailed in an envelope.

Mr. Kern said that over 95 per cent of the consumers in Philadelphia paid within the prescribed limit in order to get the discount.

Mr. E. C. Scobel, Rochester, had found that it meant additional work to arrange accounts according to account numbers. A more convenient way was to arrange the accounts by location. A discount period began on the fifteenth day of each month. About the eighteenth day a list of arrears was made up. From this list the first notices were sent out, giving until about the twentieth day for payment. In case of non-payment, a second notice followed, stating that if the account was not paid the meter would be shut off, and the customer was given until the twenty-second or twenty-seventh day. The number of first and second notices decreased each month.

Mr. Harry C. Schlegel and Mr. W. H. T. Jones, New York, spoke of the unsatisfactory experiences of the New York Edison Company with prepayment meters. The revenue from them was small and the expense of reading large. In addition the meters got out of order. The income from 125 meters in the Bronx did not average more than $100 a month and it took from one to two days to read them. The loss on the meters was due to the fact that they did not trip over properly.

Mr. Wallace, in closing the discussion, said that 4 per cent interest was allowed on customers' deposits, but every effort was made to keep them to a minimum.

PAY-ROLL PROBLEMS OF THE ELECTRIC LIGHT INDUSTRY.

W. E. Freeman, cashier, New York Edison Company, said that of the different methods of wage payment the day or hour rate plan was practically the only one adaptable to the electric light plant, as labor cannot be measured by articles produced. Because of this condition there is ever present the necessity for efficient supervision. Obsolete methods of timekeeping, preparing pay rolls and paying wage-earners are commonly used by both the large and small concerns, in disregard of the fact that they are suggestive of opportunity for irregularity, padding and collusion. Examples are numerous: (1) Where foremen or time clerks go among the workmen and ask when they arrived. (2) Where workmen enter at gates that are closed morning and noon so that late employees cannot get in. (3) Where the timekeeper checks the time of employees on sheet as they enter and depart. (4) Where the brass check is used, each employee being assigned a numbered check. (5) Where employees are supplied with time-slips on which they write down the time spent on each operation or job. (6) Where foremen or timekeepers make records of employees on the streets in time-books at the close of the day or on the following day. These methods admit of irregularity in charges against working jobs. Nearly all survive, because of the impression that time taken by an employee appointed for the purpose gives a more reliable and authentic report than that obtained by any other means.

This view, however, does not seem to be well founded. On the contrary, it appears to be certain that a mechancially made record is by far the less liable to err of the two because if the mechanism of the time-clock is regulated in its action, nothing could be more accurate than the record made by the workman himself, or made for him by the timekeeper in his presence. In the most advanced systems of plant and factory management mechanically made time records are universally employed, and it might be noted that in these cases such time is invariably accepted as correct and binding. In the introduction of new timekeeping methods and practice, the initial expense is necessarily considerable, but this is invariably more than offset by the stopping of leaks and economies effected within a limited period. The timekeeping is probably the most perplexing question for the largest plants to solve, because of operating conditions peculiar to the business. In applying the various mechanical aids for recording time it is not practical to borrow

a ready-made system. Each of the several mechanical aids has characteristics that make it peculiarly suited or adaptable to certain conditions; conversely, there is not one that would not be distinctly out of place under other circumstances. After an exhaustive study of the various mechanical appliances used for recording the time of employees, it was decided by the New York Edison Company to introduce the calculagraph as the one best adapted to the varying demands exacted.

The following statistics and information are furnished officials weekly in regard to the pay-rolls: (1) A separate detailed analysis and comparative pay-roll statement, giving the number of employees, wages and expenses as compared with the preceding week, and showing net changes and particulars for guidance of officials before approving and signing pay rolls and checks. (2) A combined weekly analysis and comparative pay-roll statement, giving the number of employees, wages, expenses and total amount of pay roll, department and division as compared with the preceding week of the same year and the corresponding week of the previous year, also giving the net changes with the percentages of increase or decrease. (3) A detailed distribution of labor charges to accounts and sub-accounts, jobs and sub-jobs. (4) A comparison between actual labor costs and original estimates, giving separate figures in each case for labor, material and indirect charges.

Discussion.

Mr. Charles R. Price, New Bedford, asked if there had been any friction between the employees and the company on account of the adoption of the mechanical devices for time-keeping.

Mr. H. R. Kern, of Philadelphia, inquired if the time of employees paid on a monthly basis was kept by mechanical devices.

Mr. W. E. Freeman, in answer, stated that some objection was raised by employees and particularly by some general foremen on the adoption of the mechanical system and it was necessary to discharge several men. The time of men on outside work was taken when they reported at the station morning and evening. Some exceptions had to be made and reliance in these cases was placed upon foremen, especially where men worked overtime. Men paid by the month were not in this system.

CARE AND HANDLING OF SUPPLIES.

Mr. John L. Baily, treasurer, Consolidated Gas, Electric Light & Power Company, of Baltimore, stated in his paper, with the above title, that his experience had shown that it is much less difficult to check and distribute labor costs than to supervise effectively the withdrawal and application of material. From the incoming of the material it is often the case, aside from such limited supervision as may be possible on the part of the superintendent, that stores representing an enormous outlay of money are practically left to take care of themselves so far as accounting for them by bookkeeping records is concerned. Apart from the question of integrity in handling material, other business considerations justify the labor and expense of keeping accurate and complete stock accounts, which form an essential part of cost records. Stores ledgers in the form of books or cards have been found the most convenient means of recording the receipt and the issue of material. The return of material drawn from stores and not used forms a most important part of the stores records. Another weak point in stock accounts is the inability to secure full and accurate reports of materials used. If the stock accounts have been kept properly a book inventory should obviate the necessity to a great degree of taking a complete physical inventory at any one time. It is probably the consensus of opinion among public accountants that in inventories materials should be valued at cost or at market, whichever is the lower. The use of stock accounts will permit judicious regulation of the stores. Storehouses should be controlled through the engineering department.

Discussion.

Mr. W. H. Bogart, New York, asked whether the stockkeeper checked incandescent lamps and described an experience of the New York Edison Company, which involved the loss of some lamps.

Mr. E. J. Allegaert, Newark, N. J., said it was necessary, first of all, to be very careful about men who were placed in charge of the storeroom or other position of trust.

Mr. Bogart said that as each package of lamps was sent out now it is checked at the gate by an inspector, who observed the destination.

Mr. Allegaert said that the storekeeper was required to make a monthly inventory and if there was a shortage or overage he was obliged to check back and try to trace it. He had paid more attention to accounting for the goods themselves than to the accounts to which they were charged, because the goods represented cash. Mr. Bailey, closing the discussion, said that the inventory should not be taken by a storekeeper, but by an independent force under the control of the auditor. An inventory of incandescent lamps was taken every three months and a daily record kept. Storeroom employees should be bonded. A storekeeper should deal with materials only and a memorandum bill, not the original, should be sent to him.

COST ACCOUNTING.

In a paper entitled "Cost Accounting," Mr. H. R. Kern, auditor, Philadelphia Electric Company, defined cost as being, in general, an "expenditure of any specified thing, as time and labor, or the equivalent, be it time, money or labor, for a thing purchased, paid for, manufactured or work done." The keynote of success in any business enterprise, especially when complicated, be it manufacturing or selling the finished product, is found in as thoroughly dependable and accurate a system of cost accounting as conditions, fixed or fluctuating, will permit. If the business is yielding unsatisfactory results, the first thought is: "Get a new machine or hire a new man," and many enterprises have failed because improved machinery was expected to accomplish what could be done only by means of an efficient accounting system. The greatest cost of production is labor and the more complex the product, the greater the difficulty to arrive at the exact cost. The second factor composing cost is burden or fixed charges. This brings in another inexact factor which is mainly concerned with (1) determination of burden; (2) apportionment of burden. The constituent elements of burden are: Indirect labor, heating, lighting, rent of buildings, taxes, insurance, depreciation and up-keep. There are three principal methods of apportionment—the percentage plan, the hourly plan and the machine-rate plan.

Reverting to the definition, cost may be summed up in two main constituents: labor and material. To compute correctly the labor cost in any case, records and systems should be so devised and kept that the total labor expenditure of a given unit is as accurate and accessible at all times as even the most interlaced and detailed working conditions may demand in factory organization and control. The cost of material is, as may be evident, more easily and correctly determinable on an average, as an expense factor, than the more or less changing and unstable labor feature. For purpose of direct addition to the first cost of material, all transportation charges, such as freight, expressage, cartage, extra handling and the like may be included. Correct records and system of supervision are essential. Owing to the rapid and constantly increasing expansion in the use of electricity in home and commercial life, necessitating enlarged equipment and extension of company lines to meet growing conditions and prompt introduction of service connections, it became necessary to know in more complete detail the exact cost of each separate job, and the working-order system was inaugurated to meet this requirement. The main contributing check on labor performed or material secured under the operation of the working-order system is that the routine be so arranged and inflexibly adhered to that before noon each day all of the previous day's charge slips pertaining to working orders be on the desk of the engineer-in-charge of each respective department, such as overhead, underground and electrical.

Discussion.

Chairman Edwards said that the classification of accounts in some States required some such system as Mr. Kern had discussed.

Mr. Alex. Holme, New York, described the job system used in the New York Edison Company. Its use was begun five years ago. Repair work was charged monthly and construction when the job was finished. Under the Public Service Commission system of accounting, requiring that the original cost be written off on replacement, it was almost a necessity that a system of this nature be followed.

Mr. W. H. Gardiner, New York, defined cost for a public service corporation as composed of operating expenses and fixed charges; the latter, representing the expense of hiring the money that created the enterprise, was just as much an item of expense as labor or coal.

Mr. E. H. Robinson, Schenectady, said that they had operated under the working order system for the last six years. A work-order number was given to each individual job and the men did not know to what account the expense would be charged.

Mr. E. J. Allegaert, Newark, thought it was very important to give a name as well as a number to a job. The system might be prohibitive in cost if made too fine.

Mr. W. E. Freeman, New York, said there was a tendency on the part of the operating department, when given the cost of a job "to date," if the total was excessive, to charge part of the cost to other jobs.

Mr. Allegaert was a strong believer in the practice of giving the local man all the information possible.

Mr. Paul Mueller, Erie, Pa., said that the accounting system was dependent entirely on the size of the company. The storekeeper sometimes commented on the prices charged for materials. He formerly kept a card record, but as this plan involved too much work in a small company, it was abolished. An inventory was taken every six months.

Mr. S. C. Rogers, Youngstown, Ohio, believed in keeping the heads of the operating departments informed as to the cost of work. All operating superintendents were furnished daily time-sheets and disbursement sheets and also, from their subordinates, copies of requisitions on the storeroom.

Mr. Kern, in closing, said that the account to which a charge was made was determined by the engineering department. Competition between superintendents at one time had led to charges on account of time and material to construction instead of to repairs and renewals, where they properly belonged. In arriving at the cost of jobs engineering and draughting were not charged to construction, but to expense, always.

DEPRECIATION ACCOUNTING FOR SMALL COMPANIES.

In his paper on this subject, Mr. G. W. Claflin, United Electric Securities Company, said it would seem that few, if any, of the members contest the existence of depreciation or the necessity for some provision for it; the differences of opinion arise when the amount of the depreciation and the method of providing for it are discussed. Those differences are entirely proper and arise from the widely differing financial and physical conditions surrounding the member companies. A uniform rate or percentage allowance for depreciation for all companies cannot be accurate and reasonable. Methods by which the depreciation allowance in each case may be determined can be formulated only as the result of time and experience. Of the different methods advocated for taking care of the losses due to depreciation, it is now generally conceded that it is better, at least for small companies, to accumulate a reserve through monthly charges for depreciation, thus spreading the amount over the life of the property and avoiding large irregular charges which would prevent reasonable comparisons of operating reports. This is the system adopted by the New York and Wisconsin commissions.

The rules of the New York commission require a monthly charge to operating expenses for the estimated depreciation to tangible property for: (1) Wear and tear. (2) Obsolescence. (3) Inadequacy. (4) Extraordinary casualties. The total of these items is intended to be the total estimated depreciation of tangible property for the month; but since certain repairs have been made, the total estimated depreciation has been reduced by the amount of these repairs. The net depreciation charge, however determined, is the estimate of the depreciation of the tangible property from all causes and might perhaps be called accrued maintenance. It is credited to depreciation reserve and appears as a liability on the books. On this plan of handling depreciation, plant account is not affected until some item of property is displaced or is modified or improved in some way. This theory intends that a reserve shall be provided that, with the present value of the tangible property, will equal the book value. This could only be true in the case of a property constructed under this system of accounting or where full depreciation allowances had already been made. The operation of the system, however, will tend gradually toward this end. A displaced item of property is to be credited to plant account at its cost, determined from records or estimated, but only so much of this cost may be charged to the depreciation reserve as has been credited to that reserve since Jan. 1, 1909, plus such depreciation reserve as the company showed on that date; the balance must be charged to surplus or deficit.

Objections are made that this system takes no account of the appreciation of property and some say that the appreciation due to increase in value of the good-will of the business, the increase in real estate, and so on, will equal and offset the depreciation. Even if this be true, which the author doubts, it would certainly be better accounting to make definite allowances for both the depreciation and the appreciation. In the case of the smaller companies under consideration appreciation of tangible and intangible property will very rarely be an item of importance and no great injustice is done by neglecting it.

Neither the New York nor the Wisconsin law requires that the accumulated reserve shall be maintained as an actual cash reserve. In the case of large companies, or wherever possible, the reserve should be an actual reserve, rather than merely a book account, and should be held in cash or perhaps bonds of the company. Maintenance of this reserve in cash is not always possible, however. In two small companies, where a depreciation reserve has been maintained for more than five years, it is not maintained in cash, but the amount has been used in the regular extensions of lines and the purchase of meters, transformers and the like.

In the case of a large company, where the system has been tested, there have been extensive replacements and modifications, both at the power house and on the distributing system, so that during the past five years more than $200,000 has been released from the depreciation reserve by displacements and changes in property. At the power station a complete switchboard, three 300-kw engine-driven units and five 375-hp boilers were displaced, due to inadequacy, and turbines and larger boilers installed, together with numerous detail changes, such as the replacing of a wooden floor in the engine-room by one of concrete and tile. On the distributing system all of the overhead construction from the power station to the center of the city, covering nearly 100 city blocks, has been replaced with underground construction. Recently 1700 old-type meters have been replaced with new meters of the latest type, because even at heavy maintenance expense it was found impossible to keep the old meters within reasonable limits of accuracy. The new and improved meters cost considerably less than those displaced, so that while the company now has better meters than before, plant account has been reduced and free cash increased by the working of the system.

The larger companies can give the smaller companies no help in determining exactly what additional annual allowance, above the regular expenditures for repairs, should be made to cover the replacement of an item, since in the experience of the larger companies inadequacy and obsolescence have always compelled the replacement of apparatus long before it was worn out. Among the smaller companies, however, apparatus may be found, still giving good and regular service, which dates back to the pioneer days of the business. One small company is today operating regularly as part of its equipment four Thomson-Houston H. I. spherical-armature, direct-current, 125-volt generators and an Armington & Sims engine, which were started up in that plant on Nov. 28, 1887, and have been in regular use

ever since. In regularity and quality of service this plant is making an enviable record, and its repair costs have not been unduly large as compared with other companies. Two boilers that formed part of the original plant were replaced about two years ago, after 20 years of service, and the manager complained that this need of replacement was principally due to the bad treatment these boilers had received in their youth. The old generators are apparently operating as well as ever, and indeed give less trouble than others in the same plant which are of 10 years' later design. In the same city there was displaced since Jan. 1, 1909, a 12-light Brush arc machine which is said to have been installed in 1880. This was regularly used for lighting a mill and was displaced from inadequacy and not because worn out.

The allowance for obsolescence and inadequacy must also be dependent upon local conditions, and among small companies will be lower in Eastern towns and cities, where the growth is slow, than in the rapidly growing cities of the West.

The tendency of the manager of a small property in first approaching the subject of depreciation due to extraordinary casualties is usually toward too high an estimate. He faces the condition of his property, with old apparatus perhaps already in need of replacement, and with no previous provision for this depreciation. If he makes his estimate upon the basis of accumulating in a year or two a sufficient reserve to provide for the depreciation of 10 years, he obtains a relatively enormous monthly charge. Such a charge would be impractical, if not fatal to his company, and he usually becomes discouraged and drops the matter entirely.

In a small company to which reference has been made, the monthly depreciation charge was made a fixed amount and entered as an operating expense item in addition to the charges for maintenance. This amount has not been changed. The maintenance and depreciation charges have equaled the following percentages of gross earnings in this case:

GROSS EARNINGS.

	Total maintenance, percentage of gross.	Additional allowance, percentage of gross.	Total depreciation, percentage of gross.
1904	8.10	8.45	16.55
1905	9.35	8.15	17.50
1906	10.90	6.89	17.79
1907	9.56	6.84	16.40
1908	10.01	7.10	17.10

A larger company previously mentioned adopted a similar system of charging a fixed monthly sum for depreciation in addition to the regular maintenance expenditures. This sum has been increased during the period, and is to-day more than three times the amount originally charged. The total depreciation for the various years is a somewhat larger percentage of gross than was the case with the small company.

The two companies above mentioned have preferred to use the replacement value of their properties as a basis for their depreciation allowance, and have each continued to make the monthly charge a fixed amount in addition to the maintenance expenditures.

Five or six years is perhaps too short a period in which to form definite conclusions, but the experience with these two properties seems to show that, in addition to regular maintenance expenditures, an annual allowance of 3 per cent of replacement value in the case of this small company and of 5 per cent in the case of the large company would properly provide for the depreciation of tangible property.

Discussion.

Mr. F. L. Dame, New York, called attention to the decision of the United States Supreme Court in the Knoxville water case that provision should be made for depreciation as it accrues.

Mr. S. F. Smith, Salem, Mass., emphasized the importance of Mr. Claflin's paper.

Mr. Claflin said that the larger company mentioned in his paper had $110,000 in cash in its fund and borrowed from it rather than outside. During the panic the company borrowed from this fund to the fullest extent. The two smaller companies had used the cash, not removing the liability from the books, but more as the larger property did, as a source for borrowing.

New Telephone Patents.

SEMI-AUTOMATIC AND AUTOMATIC SYSTEMS.

Midway between the complete automatic system and the manual system there lies the very interesting semi-automatic system of telephone operating, in which a part of the necessary functions are carried out more or less automatically under the control of the subscriber and certain others under the control of the central-office operator. The proportions of manual and automatic working which can be introduced into such a system may be varied to such an extent that many different plans of operation can be devised. One class of semi-automatic systems is what has become known as the "Call Distributing System."

Mr. S. H. Browne, of Pittsburgh, Pa., has recently obtained two patents covering such a system, which patents he has assigned to the American Telephone & Telegraph Company. In this system the subscriber has only the usual manual type subscriber-station apparatus. As in the manual common-battery system, the mere removal of the receiver from the hook effects the operation of a line relay at the central office. This line relay does not, however, immediately effect the display of a line signal, but it sets in operation an automatic selector switch. The multiple terminals of this switch are connected to trunk lines, outgoing from it and terminating in plugs with signals in front of the operators. The automatic switch at once sets about selecting the first idle trunk, displaying before the operator a signal, indicating the arrival of a call upon the selected trunk. The operator responds upon the trunk, obtains the number desired and plugs into a subscriber's multiple before her to reach the desired subscriber. At the end of the conversation she receives a disconnect signal.

One of the patents granted to Mr. Browne describes an extension of this system where two central offices are involved, the first manual operator extending the call to the distant exchange to a second manual operator. The system is worked out to provide, of course, the necessary auxiliary busy test and other signals.

Another plan of semi-automatic working is provided for in a patent granted to Mr. E. Land, of Grand Rapids, Mich., who has assigned his patent to Mr. M. G. Kellogg, of Chicago. In this system the subscriber has the usual automatic dial device, by means of which he selects an operator having control of the particular group of subscribers with which he desires communication. The arrival of the call is made evident to this particular operator by a signal displayed at the trunk line. The operator responds by means of a listening key and obtains from the subscriber the number he desires. By means of keys furnished her she then operates the connector switch of the trunk from her position, by means of which she selects the particular subscriber of her group that is desired. The mechanism and electrical details of the keyboard switches of the operator are so arranged that their automatic release or their failure to automatically release gives the operator visual supervision of the connection. Upon the completion of a conversation the operator is signaled to effect a final disconnection by the restoration of her control key.

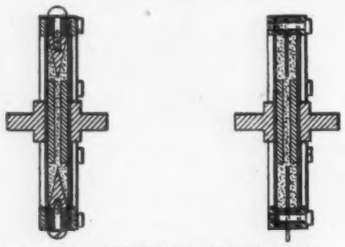
When automatic systems were first devised they were operated upon a local-battery system. It was some years before any attempt was made to introduce the central-energy system in connection with them. A patent has recently been granted jointly to Messrs. J. W. Lattig, of Wyncote, Pa., and C. L. Goodrun, of Philadelphia, Pa., for an application of this plan to the automatic system, their patent being assigned to the American Automatic Telephone Company. In order to accomplish the desired result they have included in the battery feed circuit two polarized differential relays, one coil of each of these relays being in series with a retardation coil and connected with what may be termed the "out side" of the line, and

the other two windings in series with a third relay being connected to the other side of the line. It will be seen that both polarized relays remain normal as long as equal currents are flowing in the two sides of the line. A ground at the subscriber's station, however, from one side of the line or the other unbalances both these relays, but they are so connected that but one responds at a time, the motion tendency of the other being with that of the polarizing magnet. One of the polarized relays controls the vertical motion of the selector and the other controls the rotary motion. It will thus be seen that by grounding one side of the line at a time the selector may be stepped into any desired position.

IMPROVEMENTS IN TRANSMITTERS.

We recently noted a patent for a transmitter in which the contacts between the movable electrode and the diaphragm were purposely distributed at some distance from the center of the latter. A patent has been granted to Mr. C. S. Chrisholm, of Marysville, N. B., in which the contact between the transmitter diaphragm and movable electrode is reduced to a point and made exactly at the center of the diaphragm. The contact is purely a pressure one, a pointed stud rising from the movable electrode and being held with some considerable pressure against the exact middle of the diaphragm. The diaphragm itself is made very heavy to avoid any flexure due to this pressure.

Mr. R. C. Brown, of Salem, Mass., has found that a transmitter becomes very effective the thinner the layer of granular carbon between the two electrodes and the more this layer is



BROWN TELEPHONE TRANSMITTER.

subjected to direct pressure. Because of this he has arranged baffle plates in his microphone button to prevent the granular carbon being squeezed out from between the electrodes during the operation of the transmitter. The cut shows in section two of the proposed arrangements.

Another suggested form of transmitter, also patented by Mr. Brown, uses a granular carbon film in which the electric circuit passes transversely to the line of pressure. In this transmitter one of the electrodes is a small central disk, while the other is annular and forms the cylindrical wall of the microphone button. The central disk is, of course, thinner than the ring electrode, so as to provide for free motion of the diaphragm. It will be understood that the electric circuit enters at the center electrode, passes through the film of granular carbon to the ring electrode and thus transverse to the line of pressure from the diaphragm.

NEW APPARATUS.

There have been several recent devices put on the market for providing an auxiliary ear-cap, connected by a sound-conducting tube to the regular telephone receiver. Most of these have effected little real gain in the received transmission because of the reduction of efficiency of the regular receiver and they have been a real detriment where the auxiliary ear-piece has been left tapped on and not used. Mr. J. L. Creveling, of New York, N. Y., has now patented a device of this type, which appears better designed than its predecessors. The means of attachment to the ordinary telephone comprises an auxiliary ear-piece which fits over the end of the receiver ear-cap, being held by means of a specially designed clamping ring. This ear-piece is the same shape as the receiver ear-cap and has merely the effect of thickening this latter a small fraction of an inch. An aperture extends within the body of this auxiliary ear-piece from the central hole to its edge, from which a tube extends to the auxiliary ear-cap, this latter being so designed as to cover one of the ears of the user and thereby feed sound to that ear, as well as to the one to which the receiver is presented. The leakage of sound when the auxiliary ear-cap is not used is prevented by means of a ball valve in the tube, which valve is closed whenever the auxiliary ear-cap is hanging down at the end of its tube.

Mr. F. R. Bigler, of Kansas City, has patented an antiseptic device for transmitters. This consists of a bulb, within which the disinfectant may be placed. This bulb has a stud at the end of it, which can be clamped to the perforated shield at the base of the transmitter mouthpiece, so that its center line is coincident with the center line of the mouthpiece. The bulb is of such size that a sufficient annular space is left between it and the walls of the mouthpiece to permit free access of the sound waves to the diaphragm.

As an improvement in harmonic ringers, Mr. W. M. Bruce, of Springfield, Ohio, has designed a ringer in which the moving system is supported upon a torsional wire. One end of this wire is secured to the armature of the ringer, while the other is secured to the frame, and in the vibration of the armature the torsion wire is twisted first to one side and then to the other, the torsional stress tending to assist in keeping the hammer in vibration.

Letters to the Editors.

Calibrating the Ballistic Galvanometer.

To the Editors of Electrical World:

Sirs:—The article by Prof. C. M. Jansky in your issue for April 8 and your editorial on the same present a very interesting and simple way for correcting the errors caused by changing the resistance of a closed circuit kept on a ballistic galvanometer during its swing.

I wish to call attention to the fact that certain careful writers on magnetic testing by the ballistic method have for a long time advised the use of a special discharge key when finding the quantity constant of the ballistic galvanometer by the condenser method. This key on first contact discharges the condenser through the galvanometer and then by the same movement, when pressed a trifle lower (and before the swing is well begun), short-circuits the galvanometer through either the same or an equivalent circuit to the one used in the magnetic tests. The galvanometer thus swings under the same conditions when used in the induction tests and while the calibration tests are made, and hence the correct constant is obtained without any secondary tests.

But it should be more generally understood than seems to be the case that the quantity-constant of any galvanometer suitable for ballistic work is always dependent upon the constant of the galvanometer for steady current, the period of the swing and the damping factor of the galvanometer. The quantity-constant may always be computed from these other properties. The exact relations are either stated or implied in nearly every standard work on electrical measurements. They are:

Constant for quantity $= 1/2\pi$; constant for current $\times$ period $\times (1 + \frac{1}{2}\lambda)$ in which λ is the well-known logarithmic decrement, and is found in the usual way.

Any change in the circuit used on the galvanometer cannot in itself affect the constant of the galvanometer for steady current, and hence the only change in the quantity constant that can be caused by adding, removing or changing the resistance of a closed circuit on the galvanometer terminals must be connected with, and must be proportional to, changes in the period and in the damping factor. If then the period and the damping factor be determined for the two different conditions, the ballistic or the quantity constant may be corrected from either condition to the other. Moreover, when the change is not too great, the period will remain constant and only the damping factor, or $(1 + \frac{1}{2}\lambda)$, need be determined in order to reduce the

quantity constant from one condition of use to another, or to compare ballistic throws that were obtained under different conditions; as, for example, when the resistance of the circuit on which the galvanometer was used did not remain the same at all stages of the test.

POTSDAM, N. Y. B. B. BRACKETT.

The Tariff on Mica.

To the Editors of Electrical World:

SIRS:—In your issue of May 20 there appeared an article entitled "Duty on Mica," in which Mr. W. J. Gibson attempts to point out the unfairness of the present or proposed tariff tax on this material. The writer desires to take exception to some of the statements, as follows:

Up until 1890 there was very little or practically no mica mined in the United States, even at points where it was known to exist, mainly due to the fact that Americans could not compete with India, where laborers and miners received the equivalent of 10 cents to 20 cents per day.

Mica is a product of nature, the same as all minerals, but Mr. Gibson's statement that it is easily taken out of the ground is not correct, as the mining of mica is fully as costly as that of any other mined mineral, and more so than coal, iron ore and a number of other minerals.

Mr. Gibson may not be aware that in the United States from 75 per cent to 90 per cent of the mined mica is waste, not suitable for other disposition than grinding; and that only 25 per cent as a maximum is secured in a cut state, so that the cost of working it after it is mined is great.

He also states that this country consumes 10 times as much mica as is found here. This I believe to be a mistake, as the United States is producing more mica every year, and it is being found in all sections of the country. A great deal more would be produced if the price would justify, but many mica industries in this country have been compelled to go out of business by reason of being unable to compete with the very low rate of wages paid in India.

Mica is now being produced in considerable quantities in New Hampshire, North Carolina, Virginia, Georgia, Idaho, New Mexico, Colorado, Wyoming and in very large quantities in South Dakota. When the time comes that the tariff duties reach a point to make its production profitable the entire demands of the United States can be supplied with mica mined within its borders.

RIDGEWAY, VA. FRANK N. MEYER,
Pittsburgh Mica Company.

[If our correspondent will refer to the statistics available on the subject, particularly to the publications of the United States Geological Survey, he will find that the greatest production of mica, in value, was in the year 1884; and that the production for the years 1881, 1882 and 1883 equaled or exceeded in value that of any year in the history of the industry except the year 1907. While the production, in pounds, in the years 1880 to 1884 is reported as very much smaller than in any year subsequent to 1900, the reason is that the process of building up mica from small sheets was not then used, only the larger sizes being put on the market. Of the mica now usable only from 10 to 20 per cent was formerly merchantable, and the actual output, therefore, in the years 1880 to 1884 was probably nearly as large as the recent output. The Ruggles mine, in New Hampshire, by far the largest and richest mica mine in the country, has lain idle since 1890, although worked for 60 to 70 years prior to that time. As to the waste in producing sheet mica, the percentage can vary slightly in different places, and is probably as large in India as in the United States. In an article on mica by Mr. Jos. Hyde Pratt, in "Mineral Resources," published by the United States Geological Survey, a statement is made that only 10 to 15 per cent of the mica mined can be cut into sheets, the rest being waste or scrap. As to a comparison of mica produced in the United States and that imported, an article in our issue of Dec. 19 shows that an increase of over 100 per cent in the price of mica led to only a small increase in production in this country. The reason for this is that our deposits are not sufficiently rich or numerous to admit of any great increase in the output. Even granting that it would be possible by a large duty to stimulate the production in the United States to an amount equal to the requirements, it would be extremely unjust to compel users of mica to pay what would actually be an enormous bonus to mine owners. There have never been as many as 1000 employed in mining mica in this country, and larger employment in the industries using mica can in no manner be affected by the question of home production or importation. The present duty on mica amounts to 100 per cent, and even 150 per cent on some sizes, which is a serious tax on the electrical industry, as may be evident from the fact that in the year 1907 one electrical manufacturing company imported alone over 1,000,000 lb. of mica.—EDS.]

Patent Abuses.

To the Editors of Electrical World:

SIRS:—The writer has noted with interest the various articles and communications appearing in your journal respecting the necessity of improving our patent laws, and it may not be amiss to direct attention also to some evils which have come to his attention in marketing patents here and abroad. These evils furnish examples of rascality which amount to petty thievery or worse; it is to be regretted, however, that it seems almost impossible to prosecute those engaged in the practices, and this furnishes a reason for making the subject public at this time.

An inventor is usually so situated financially that he cannot manufacture his creation from his own resources, in which case it becomes necessary for the disposal of his patents to be left to others. Immediately the announcement is made in the *Patent Office Gazette* that a patent has been issued, the inventor is the recipient of numerous letters from as many different parties setting forth marvelous opportunities for disposing of his invention. In most cases the common end sought by the writers is the exaction of a tribute in the shape of a "fee," upon receipt of which all interest in the inventor or his device too often ends. Another scheme very frequently worked is along these lines:

A patentee receives a letter reciting the fact that it has come to the notice of the writer that a patent has been allowed to him, that the writer believes the invention to be a meritorious one, and that it should be worth a fortune, the amount of which, of course, is placed at a figure the writer thinks the invention can stand. It is set forth, in addition, that special facilities for the quick and profitable disposition of patents are enjoyed by the writer and that he should be glad to undertake the same, etc.

This plausible bid for business generally brings a reply from the inventor, who, naturally, is anxious to realize from his labor. It is then, however, that the real purpose of the "agent" or "agents" becomes clear, it being set forth in the second letter of the "agent" that it will be necessary for the inventor to remit a preliminary "fee" of from $25 to $50 to cover the cost of investigating the patent and the possible market therefor. The remittance of this "fee" is often the final act in the farce.

Another very ingenious scheme for trapping the unwary inventor—the one against which the loudest warning should be sounded because it often results in the absolute loss to him of his patent—is that of the unprincipled "agent" or "attorney" who represents to the patentee that his invention is worth a fortune and that he, the "attorney," is in a position to obtain a large sum of money for it. He points out, however, that it will first be necessary to incorporate a company, the capitalization suggested being such an amount as to dazzle the inventor, the patentee to assign his patent to the corporation in consideration of a block of the stock. The underlying purpose of the whole transaction, however, is merely to secure from the inventor from $100 to $200 to cover "incorporation expenses," the larger part of which finds its way into the pocket of the "attorney" or the "attorney" of the "agent."

It is quite needless to say that parties who indulge in this sort of practice have not that standing, financially or otherwise, which is necessary to the raising of any considerable sum of money, no matter how meritorious the invention may be, hence the inventor not only loses his time and money, but sometimes his patent as well, for immediately upon the formal incorporation of the enterprise the promotion thereof languishes.

The reprehensible practices above referred to should be stopped somehow soon if the Government has to go to the extreme of sending a circular to inventors at the same time they mail the certificate of award.

The protection of the inventor by the Government is most essential. Civilization goes backward without him. Germany is doing so much to protect the producers of new ideas that it should put us to blush when we consider seriously our shortcomings. It used to be that almost everything new in England was called "the lastest Yankee idea." This order of things is passing, and now everything new, more or less, is "Made in Germany." Why is it? The answer is that our Government is not protecting the inventor properly and legal fights are so expensive as to be out of the realm of possibilities for the average inventor. Did you ever hear of representatives of large concerns saying: "It is better to infringe and then to fight"? They know the inventor's weak spot. Germany runs away with the persimmon.

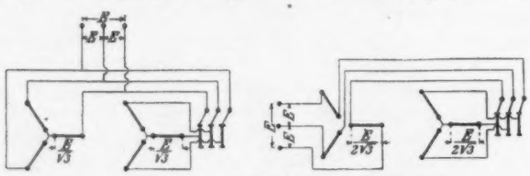
New York. Frank Z. Maguire.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Double-Field Generators.—E. Ziehl.—The principle of double-field generators is that they can furnish electrical energy from the stator as well as from the rotor. The rotor is driven at a speed double the synchronous speed in the direction opposite to that of its own rotary field. The stator windings and the rotor windings are perfectly equivalent, voltages, currents and frequencies being the same, so that they can be connected in series or in parallel. Fig. 1 shows a three-phase, double-



FIGS. 1 AND 2.—DOUBLE-FIELD GENERATORS.

field machine with parallel connection. Fig. 2 shows the same machine for series connection. The parallel connection is suitable for machines with relatively low voltages, the series connection for high-tension machines. The generators have only one stator and one rotor winding, and are otherwise quite similar to ordinary three-phase motors. They are excited by three-phase currents, in general from ordinary synchronous machines, with which they are operated in parallel, or by synchronous motors excited with direct current. Compared with the ordinary synchronous generator, the double-field generator has certain advantages, especially for high speeds. It is easier to design the double-field generator to suit the high speeds of steam turbines. The author claims that the cost of making the turbo-double-field generator is now generally only one-half the cost of the ordinary generator excited with direct current. The double-field generator is especially suitable for three-phase installations. In such cases it is advantageous to install an ordinary synchronous machine in the central station to set the pace, while the other machines may be double-field generators. —*Elek. Zeit.*, May 20.

Interpole Motors.—W. Siebert.—The author distinguishes two main groups of interpole machines. In the first group the form and number of the interpoles are such that the commutation of all coils takes place in a homogeneous commutation field; and that the external field has no effect. In the second group the form and number of the poles are such that not only the commutation field but the external field has an influence on the commutation of the coils. The author's calculations show that the ordinary slotted motor, if it is to be provided afterward with interpoles, must always belong to the second group. It is then not suitable for reversal of the direction of revolution and for heavy variations of load. Perfect commutation can be obtained only with motors of the first group. From the constructive design of the same the author concludes that they would not be suitable as normal machines for small capacities, say, below 20 kw.—*Elek. Zeit.*, May 20.

Interpoles.—W. B. Hird.—A paper read before the Glasgow section of the (Brit.) Inst. Elec. Eng. The author dealt with the application of interpoles to machines of normal design, and pointed out that full advantage was not taken of the increased armature lengths made possible by this means. The consequent increased heating would, however, lead to forced ventilation, to which he saw no objection. In the discussion following the paper, W. W. Lackie referred to the difficulty of running interpole machines in parallel with ordinary shunt machines. H. A. Mavor and J. R. Barr were of the opinion that in most cases it would still be better to avoid interpoles.—Lond. *Electrician*, May 21; *Elec. Eng'ing*, May 20.

Polyphase Commutator Motors.—E. Roth.—A continuation of his long theoretical serial. The author discusses the different losses and shows how to predetermine the behavior of a motor from the general circular diagram if the phase and value of the voltage impressed on the rotor are given. He further discusses the problem how to determine the phase and value of the voltage impressed on the rotor, if the torque and speed are given.—*La Lumière Elec.*, May 15 and 22.

Lamps and Lighting.

Popularity of Electric Lighting.—E. Wikander.—The author thinks that the introduction of metallic-filament lamps has cheapened electric light to such an extent that it can compete with the kerosene lamp. He thinks that the greatest obstacle to the general use of electric lamps by the middle class and the poorer people is the comparatively great expense of wiring. The author thinks that the central stations should themselves bear the cost of wiring, and that this cost should be covered by one of several methods which are discussed. The author proposes the use of the flat rate for small consumers in order to reduce the expense of meters. Finally it is urged that electric lighting should be favored officially for sanitary reasons and that fire-insurance companies should reduce the premium for electrically lighted buildings on account of less danger. In an editorial note it is questioned whether electric lighting can be called popular. In 1905 they had 26,438 buildings in Berlin with 522,558 dwelling places, while the Berlin Electricity Works had connections only to 7836 houses and 12,939 consumers. The editors think that the obstacle which prevents the general use of electric lighting is the present price of the electric current for lighting.—*Elek. Zeit.*, May 20.

Arc-Lamp Mechanism.—A note on a recent British patent (16,151, 1908; May 13, 1909) for an arc-lamp mechanism invented by the Jandus Arc Lamp & Electric Company and A. D. Jones. A lamp mechanism for vertically arranged carbons is described, in which two iron cores, controlled by shunt and series solenoids in the usual manner, are supported by a rocking lever pivoted near its center. The upper carbon is supported by a clutch, and connected by links to one end of the rocking lever. The entire weight of the mechanism is thus supported at the fulcrum of the lever, which, according to this invention, is provided with ball bearings. This, it is claimed,

will ensure close regulation and steady burning of the lamp.—Lond. *Elec. Eng'ing,* May 20.

Tungsten Lamp.—An announcement by a British manufacturing company that they are now in a position to deliver "Aegma" metallic-filament lamps (tungsten) from 16 cp for 100 to 130 volts with bulb of a similar size to those of ordinary carbon-filament lamps, at a list price of 75 cents each.—Lond. *Elec. Eng'ing,* May 20.

"Intensified" Enclosed Arc.—W. D'A. RYAN.—An illustrated article on the "intensified" enclosed arcs with two small-diameter upper positive carbons and one lower negative carbon.—*Gen. Elec. Review,* June.

Arc Lamps for Therapeutical Purposes.—The first part of an article on the special construction of arc lamps for treatment of skin diseases by the method of Finsen.—*Elek. Anz.,* May 20.

Power.

Refuse Destructor Plant.—J. A. ROBERTSON.—A paper read before the Glasgow section of the (Brit.) Inst. Elec. Eng. giving the results of one year's operation of the refuse destructor plant at Greenock. The first condition for success is that the demand for energy shall be fairly steady, so as to obviate storage of refuse or by-passing the furnace gases to the chimney at times of light load. A residential district is, therefore, not very suitable for a combined installation; a power or tramway load is desirable. On the average, from 15 cwt. to 1 ton of refuse is collected at Greenock per day per 1000 inhabitants; its value varies with the district and season, ranging at Greenock from 86 units per ton in October to 24 in July, when the supply is also at its lowest. The fluctuation in the quality of the refuse is the greatest drawback to its use, necessitating stand-by, coal-fired boilers to maintain steady pressure. In Liverpool over 9,000,000 kw-hours were generated from refuse in 1907, using non-condensing engines that took 50 lb. of steam per kw-hour; in most cases the fuel costs of combined stations are lower than those of stations run on coal. Liverpool only pays 0.4 cent per kw-hour for energy generated from refuse. Generally it is exceedingly difficult to appraise the value of destructor steam accurately. At Greenock the generating station has been run on coal for three months before the destructor commenced working, so that an accurate comparison of running costs was possible. The allocation of costs was made on the basis of 4½ lb. of coal per kw-hour generated, with coal at $2.50 per ton, and after allowing for capital charges on boilers and pumps, 0.7 cent per kw-hour was paid to the cleansing department for steam. Fig. 3 shows the work done

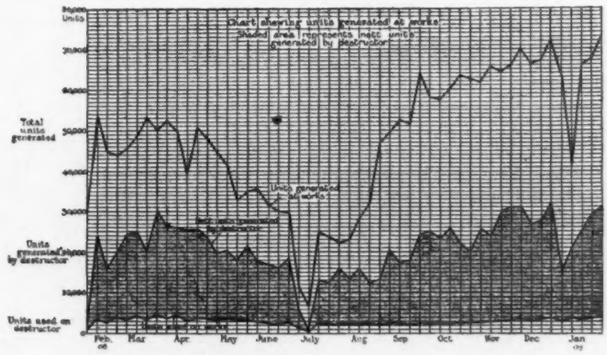

Total units generated
Units generated by destructor
Units used on destructor
Feb. Mar. Apr. May June July Aug. Sep. Oct. Nov. Dec. Jan.

FIG. 3.—OUTPUT OF GREENOCK DESTRUCTOR, 1908-9.

by the destructor during the 12 months ended Jan. 31 last. Of the energy generated by the destructor, 12 per cent was used for power and light, 8.5 for fan draught, 1.0 for cranes, 1.4 for clinker treatment, and 1.1 for lighting; the price charged for this energy was 0.61 per unit, on a 35 per cent load factor. On an eight-hour test, Oct. 29, 1908, with a pressure of 4.6 in., burning 324.72 tons of refuse per cell per 24 hours (103 lb. per square foot of grate per hour), the water evaporated per pound of refuse was 1.41 lb. from and at 212 deg. Fahr.; the mean pressure was 195 lb. per square inch; superheat, 564 deg. Fahr.; feed-water temperature, 91.5 deg. Fahr., on entering economizer, and the electrical output 97 units per ton of refuse. The average result over a whole year's working was 67 kw-hours per ton, the highest output, including all stand-by losses on the station, that the author had met with. The capital cost of the destructor was $99,000; labor cost 28 cents per ton for operating the destructor, and 4 cents per ton for treatment of residue; other expenses brought the total to 54 cents per ton. Sale of steam and clinker brought in 51 cents per ton, leaving a net balance of 3 cents. The net cost of disposal was 43 cents per ton. During the year 16,985 tons of refuse were destroyed, 1,142,064 kw-hours generated from it, 5338 tons clinker produced, and 1286 tons sold.—Lond. *Electrical Review,* May 21.

Electric-Power for Rolling Mills.—W. F. MYLAN.—A paper read before the Leeds section of the (Brit.) Inst. Elec. Eng. on the electrification of steam-driven, non-reversing rolling mills. In Europe at the present time there are upward of 230 electrically driven reversing rolling mills in operation, the total horse-power exceeding 200,000. The electric driving of rolling mills is quite past the experimental stage, and it is not only possible to estimate with accuracy the size and other details of the equipment, but also to determine the actual cost of operation under any given conditions. The author gives a list of 28 installations in England and describes some typical equipments. "The crux of the whole question of rolling electrically is whether or not a reasonably cheap source of power is obtainable either from a private generating station or from an outside source, and this obtained, electrically rolling will be found to be considerably cheaper than steam."—Lond. *Electrician,* May 21.

Steam-Electric Stations.—H. M. HOBART.—The conclusion of his article on the rating and cost of steam-electric generating stations. In the former installments, the author has discussed the average cost at the generating station per kw-hour delivered from the station. This cost does not, however, serve, without further analysis, as a suitable basis from which to arrive at the equitable price to charge individual consumers. The charge for the energy delivered at the consumer's premises should depend on the power factor of the consumer and other matters. While the consumer's-load factor and the station-load factor are quite different matters, it is interesting to see that the average cost per kw-hour delivered from stations designed for various load factors bears a considerable resemblance to the prices to consumers with various load factors, which analysis and experience have indicated to be appropriate.—Lond. *Elec. Review,* May 21.

Electric Cranes.—H. H. BROUGHTON.—In a continuation of his long illustrated serial on electric cranes, the author discusses the lifting mechanism and describes in the present installment mechanical brakes and limit switches.—Lond. *Electrician,* May 21.

Power Transmission.—R. DE LA BROSSE.—A paper read before the French Association for the Advancement of Science on the principal features of the project of Blondel, Harle and Mahl, of power transmission from the Rhone River to Paris; three-phase transmission at 120,000 volts over a distance of 250 miles being contemplated.—*La Houille Blanche,* May.

Traction.

Effect of Single-Phase Traction on Telephone Lines.—BEHN-ESCHENBURG.—An English translation of his recent paper which has already been noticed in the Digest. Though deduced primarily from experience gained with Oerlikon motors, the results given in the article are of quite general interest to all connected with single-phase traction, and show how both difficulties of design and outside disturbances set up in neighboring telephone lines have been successfully overcome until finally the single-phase series commutator motor bids fair to outrival any of its competitors for main-line railway work.—Lond. *Electrician,* May 21.

High-Tension, Direct-Current Traction.—G. H. HILL.—An article on the advantage of a 1200-volt, direct-current railway, pointing out the possibility of using practically standard apparatus throughout.—*Gen. Elec. Review,* June.

Installations, Systems and Appliances.

Effect of Metallic-Filament Lamps in British Central Stations.—The first of the annual accounts of British central stations for the year ending March 31 last have appeared. The most interesting are the Leeds and Burton-upon-Trent accounts. At Leeds the number of kw-hours sold for private lighting has decreased by over 530,000, or about 10 per cent, representing a loss in receipts of $39,210, while, in spite of an increase of 1563 hp, or 18 per cent, in the motors connected to the mains, the revenue from this source shows a diminution of $9,675, due to reductions in the scale of charges, the final result being a total reduction in revenue of $46,440. In spite of this discouraging feature, the gross profit and also the net surplus show increases, due to careful management and a reduction in the "exceptional" expenditure on renewals. Trade depression, of course, accounts for some of the loss of revenue, particularly as regards power users, but metallic-filament lamps have played an important part, since it is found that where these are installed consumers have reduced their energy consumption very considerably. The result of such reduced cost of electric lighting will certainly be a considerable addition of new consumers, but this takes time for its effect to be felt. At Burton-upon-Trent, the effect of metallic-filament lamps has also been very noticeable, the revenue from lighting consumers, in spite of a larger increase in the number of lamps connected than for several years past, being $30,485, a decrease of $1,830 compared with the previous year, and also a lower figure than that recorded in 1907. The restricted-hour system of power supply, which P. J. Pringle has advocated, has been, however, the mainstay of the undertaking, and, notwithstanding the depressed conditions of trade in the town, the revenue from power users has increased by $2,670, representing an increase of 33 per cent in the number of power units sold. The most interesting features, however, is the fact that the average price of all units sold for motive power is only 1.96 cents, which low figure should result in a considerable access of new business when the trade conditions once again improve. The development of the motor and heating and cooking loads seems to furnish the best results during the temporary reduction in output brought about by the introduction of high-efficiency lamps. —Lond. *Electrician,* May 21.

British Central Station.—An account illustrated by diagrams showing the development of the St. Marylebone Borough Council electricity undertaking during the past three years. The number of consumers has increased by 14.4 per cent, the rate of increase being practically constant; the number of kw-hours sold increased by 26.4 per cent in the first year, but by only 2.4 per cent in the last year, owing to the introduction of metallic-filament lamps. The total number of kw-hours sold for all purposes last year amounted to over 9,000,000.—Lond. *Elec. Eng'ing,* May 20.

Regulators.—An illustrated article by F. W. Shachelford on feeder regulators and their importance in alternating-current systems of distribution, describes the induction-type and switch-type of regulator. Another illustrated article by H. A. Laycock describes the principles of construction of regulators for alternators.—*Gen. Elec. Review,* June.

Wires, Wiring and Conduits.

Aluminum and Copper.—M. W. Franklin.—A chart giving for a given copper price directly the price of aluminum for which lines made of the above metals will cost the same. The chart is based on the following figures: The conductivity of aluminum is 63.3 per cent of hard-drawn copper. The specific gravity of aluminum is 30.20 per cent that of hard-drawn copper. The same chart also permits finding directly the savings in per cents, which can be obtained with aluminum or copper if the prices of the two metals are not equivalent.—*Gen. Elec. Review,* June.

Electrophysics and Magnetism.

Glow in Vacuum Tubes.—S. V. Gill.—A note on a Royal Society paper on the nature and causes of a phenomenon observed by the author when occupied with a research connected with a palladium foil. A piece of palladium foil, or platinum foil coated with palladium black, was heated to a white heat in air at a pressure of about 0.15 mm. A purple-blue glow was seen to surround the hot metal, while between the glow and the palladium there was a dark space. The thickness of the dark space varied with the temperature of the foil. The glow disappeared when the tube was heated to a high temperature, and returned when it was cooled. It was shown that the presence of the glow depended on a reaction between the gases introduced into the tube, when the palladium was heated, and the disintegrated particles of palladium. Water vapor has to be present in the tube, and the glow could be made to disappear by freezing out the vapor by means of a few drops of liquid air applied to the outside of the tube, or by introducing some phosphorus pentoxide into the tube. The spectrum of the glow showed certain regions which corresponded to portions of the spectrum of carbon monoxide gas. It was also shown that carbon monoxide was present in the tube which showed the glow. No effect was observed when electric and magnetic fields were applied to the glow. The probable cause of the luminosity is the union of carbon monoxide and oxygen brought about by palladium charged with hydrogen, in the presence of water vapor. A second effect was also briefly described; this appeared to be due to the causes which gave rise to thermo-luminosity.—Lond. *Electrician,* May 21.

Selenium.—A. H. Pfund.—An account of an investigation in which the author made a new determination of the conductivity or sensibility curve of metallic solenium. This curve is given in Fig. 4, in which the abscissas represent the wave length and

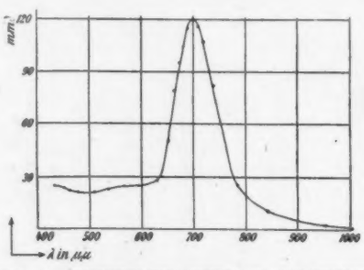


FIG. 4.—SENSIBILITY CURVE OF SELENIUM.

the ordinates the galvanometer deflection in millimeters. Absorption and reflection curves were also determined and a theory is proposed to explain the sensibility maximum and the fact that the position of the maximum is displaced toward shorter wave lengths if the intensity of the light is increased.—*Phys. Zeit.,* May 15.

Thermodynamics.—C. P. Steinmetz.—The conclusion of his serial on thermodynamics. The author considers the general steam characteristics of the expansion and impulse types of turbines and their relation to turbine velocity, leading up to a discussion of the combination turbines which are now in commercial use. The author comments on the equivalence of superheated steam and negative moisture, and concludes with a warning in reference to the application of the steam energy equations to turbines.—*Gen. Elec. Review,* June.

Electric Oscillators.—A. Montel.—A discussion of the field produced by electric oscillators of different types. The open oscillator of Hertz, the closed oscillator, and the semi-closed oscillator are discussed.—*La Lumière Elec.,* May 15 and 22.

Heat Conductivity.—M. Reinganum.—A theoretical paper on the question whether internal radiation has any essential influence on the heat conduction in metals. The result is that internal radiation is so small as to be negligible with respect to heat conduction.—*Phys. Zeit.,* May 15.

Electrochemistry and Batteries.

Fixation of Atmospheric Nitrogen.—Schoenherr.—An illustrated description of the new process of the Badische Company, which is in use on a large scale in Norway. It differs from the Birkeland-Eyde process in that a long, quiet arc is used, the air being passed along the arc. Very long alternating-current arcs are used having a length of 5 m (60 ft.) in 600-hp

furnaces and 7 m in the 1000-hp furnaces. The method of getting a quiet arc which will burn continually is very simple. If the air is passed in a helical path around the arc the alternating-current arc loses its unstable character and becomes as quiet as a candle; it is then possible to include it within a rather narow metallic tube without running the risk of the arc forming contact with the walls of this tube. The furnace construction is shown in Fig. 5. It consists essentially of a number of concentric iron tubes. To start the arc the artificial electrode *Z* is provided which can be brought in contact with the electrode *E*. On removal of *Z*, the arc starts and travels upward. The upper end of the arc always then travels around within the water-cooled upper part *K* of the iron tube through which the air is passed. The electrode at the bottom is an iron rod *E* within a water-cooled copper cylinder. The iron electrode is gradually consumed, but its life is about 2000 hours. The arc plays in the innermost iron tube 4 and through it the air is passed upward. The air which is subjected to the high temperature of the arc is introduced near the lower electrode through eight holes, which may be more or less closed by means of the slider *S*. When the air enters through these holes into the innermost tube it is already preheated. The path of the air through the furnace is indicated by arrows in Fig. 5. The air enters at *e*, rises upward in tube 2 and downward in tube 3 (being preheated in tubes 2 and 3), passes through the eight holes near the bottom into the innermost tube 4, where it is changed into a gas mixture containing nitrogen oxides. This gas mixture, after having risen to the top of the furnace, again passes down through the outer tube 1 and is withdrawn from the furnace through *d*. The methods of absorbing the nitrogen oxide gases for the manufacture of nitrites, nitrates and nitric acid are also discussed.—*Electrochemical and Met. Industry*, June.

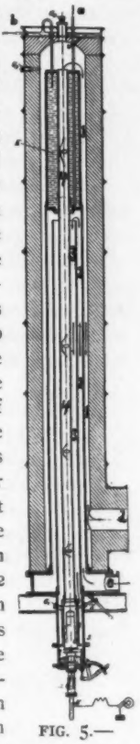


FIG. 5.—DIAGRAM OF FURNACE.

Ozone for Sewerage Treatment.—An illustrated description of the installation of ozone apparatus for the purification of drinking water in Nice. It is also suggested to apply the ozone process to the treatment of sewerage effluent. This is believed to be quite practical.—Lond. *Electrician*, May 21.

Electric-Steel Furnaces.—W. RODENHAUSER.—An Iron and Steel Institute paper in which the author first briefly considers electric-arc furnaces and points out what he considers the disadvantages of each type. He then passes on to the induction furnace and describes the Rpechling-Rodenhauser combination furnaces installed at Völklingen. The capital cost of the various types of furnaces is also discussed.—Lond. *Electrician*, May 21.

Units, Measurements and Instruments.

International Candle.—An official announcement of the (British) National Physical Laboratory in London, on the change already discussed editorially in *Electrical World*, April 22, page 949. The unit of light at the Bureau of Standards (Washington) has been maintained through the medium of a series of incandescent lamps, the values of which were originally intended to be in agreement with the British unit, being made at 100/88 times the Hefner unit. The unit of light at the Laboratoire Central (Paris) is the bougie decimale, which is the twentieth part of the standard defined by the International Conference on units of 1884, and which is taken, in accordance with the experiments of Violle, as 0.104 of the carcel lamp. The unit of light at the Reichsanstalt (Berlin) is that given by the Hefner lamp burning at normal barometric pressure (76 cm), in an atmosphere containing 8.8 liters of water vapor per cubic meter. The unit of light at the National Physical Laboratory (London) is that given by the 10-cp Harcourt pentane lamp, which was described for use by the Metropolitan Gas Referees, burning at normal barometric pressure (76 cm) in an atmosphere containing 8 liters of water vapor per cubic meter. Extended and careful comparisons have shown that the pentane unit has the same value winthin the errors of experiment as the bougie decimale. It is 1.6 per cent less than the standard candle of the United States of America and 11 per cent greater than the Hefner unit. In order to come into agreement with Great Britain and France, the Bureau of Standards of America proposed to reduce its standard candle by 1.6 per cent provided that France and Great Britain would unite with America in maintaining the common value constant, and with the approval of other countries would call it the international candle. The National Physical Laboratory (London) and the Laboratoire Central d'Electricité (Paris) have agreed to adopt this proposal in respect to the photometric standardization which they undertake, and the date agreed upon for the adoption of the common unit and the change of unit in America was April 1, 1909. The following simple relations will, therefore, hold after that date:

Proposed new unit or international candle
= 1 pentane candle
= 1 bougie decimale
= 1 American candle
= 1.11 Hefner candle
= 0.104 Carcel unit

therefore, 1 Hefner unit = 0.90 of the proposed new unit.

The pentane and other photometric standards in use in America will hereafter be standarized by the Bureau of Standards in terms of the new unit. This, within the limits of experimental error, will bring the photometric units for both gas and electrical industries in America and Great Britain, and therefore the electrical industry in France, to a single unit, and the Hefner unit will be in the simple ratio of 9/10 to this international unit. In an editorial note the hope is expressed that Germany shall also give up the Hefner, mainly for commercial reasons in view of Germany's important position in the lamp industry. It is thought that the general public will not understand that 11 hefner candles and 10 international candles are the same and will prefer German lamps because they are marked with the higher figure of candle-power.—Lond. *Electrician*, May 21.

Tests of Dielectrics.—T. GERMANN AND S. M. HILLS.—The authors discuss the properties of insulating materials and describe the various tests they consider ought to be applied to the different substances. Particulars of a new method of testing are also given. This is called the "slot method" and is used for testing dielectrics which are to be used in the insulation of armature coils. The method essentially consists in testing a sample of the dielectric in a laminated iron slot, a sketch of the apparatus shown in Fig. 6, where *A* represents the alternating-current supply circuit; *B*, the iron laminations; *C*, clamping

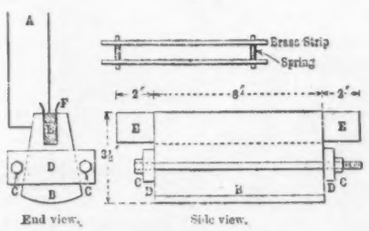


FIG. 6.—TEST OF DIELECTRICS.

bolts; *D*, iron plates; *E*, brass conductor; *F*, the dielectric under test. The authors consider that this method of testing more nearly approaches practical conditions than the parallel plate method (used at the Hermsdorf Porcelain Works) does, although they do not advocate the abolition of the latter method. At first, however, it seemed to possess the disadvantage that several conductors of various sizes were required. To obviate this the authors recommend the use of a conductor, as shown in the illustration, which consists essentially of two brass strips kept apart by two spiral springs. Electricity readily discharges from points, and as in a laminated slot there are several points or ridges, it was expected that there would be considerable difference between the results of the open-slot

system and the parallel plates. This was found to be the case, and figures given in the paper show a percentage of difference of from 17.5 to 59.5 per cent. The relation between dielectric strength and thickness does not follow a straight line law, but as the slope of the curve of the various dielectrics tested was about the same and not much different from a straight line, the authors adopted the term breakdown voltage per mil, as a convenient standard of comparison. Present methods of raising the voltage are of a jerky nature, and in order to obtain a smooth and yet rapid regulation the authors employed the

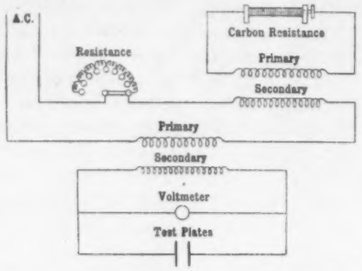


FIG. 7.—ELECTROMAGNETIC BALANCES.

method illustrated in Fig. 7. A long-range transformer is placed so that the secondary is in the supply circuit and the primary forms a circuit of its own through a variable resistance of carbon or water. This forms the regulation; another transformer is shown, being employed in the usual manner for stepping up the voltage. The transformer, which should be leaky and able to withstand a short-circuit, resolves itself into a choking coil, and as the actual regulation is done in a separate circuit the increase in voltage must be gradual. To avoid a rush of current at first switching on, a resistance is introduced into the main circuit.—Lond. *Electrician*, May 14.

Quadrant Electrometers.—E. Orlich.—The conclusion of his illustrated paper on an investigation carried out in the German Reichsanstalt on the use of the quadrant electrometer for alternating-current measurements. The author describes methods and apparatus for making voltage and power measurements by means of the quadrant electrometer. The same apparatus is used for low as for high voltages and for low as for very strong currents. The measurement of the power is very exact even for a large phase difference. Finally, methods are described for determining the phase difference and the ratio of transformation of testing transformers for any secondary load. —*Elek. Zeit.*, May 20.

Exhibition of Instruments.—J. Reyval.—The first part of a description of the different exhibits at the recent exhibition of the French Physical Society in Paris. In the recent article various electric measuring instruments (galvanometers, pyrometers, voltmeters, ammeters, the transportable photometer of Heller, three-phase precision wattmeter of Siemens, potential transformers for high-tension measurements, the frequency meter of Frahm, etc.) are described.—*La Lumière Elec.*, May 22.

Telegraphy, Telephony and Signals.

Pupin Telephone Lines.—F. Breisig.—It is generally claimed that the damping of a telephone line loaded with Pupin coils is independent of the frequency, so that all frequencies are equally damped without distortion. The present author endeavors to shows that the damping of Pupin lines also depends in a greater or less degree on the frequency, even if the resistance and inductance of the coils do not change with the frequency.—*Elek. Zeit.*, May 20.

Wireless-Telegraphy Testing.—J. A. Fleming and G. B. Dyke.—An illustrated paper read before the Physical Society of London, in which the authors show that by using two closed oscillatory circuits placed, say, 50 ft. to 150 ft. apart, the equivalent for testing purposes of radio-telegraphic stations with open oscillators at very large distances can be obtained. A description is given of the apparatus at University College, London, and of tests on various detectors.—Lond. *Electrician*, May 21.

Fire-Alarm Regulations.—J. Doenitz.—An illustrated article discussing the regulations of the Association of German Fire Insurance Companies on the installation of automatic fire-alarm systems. If such a system complies with the regulations a lower premium is charged for insurance.—*Elec. Zeit.*, May 20.

BOOK REVIEWS.

La Definition et la Mesure Industrielles de l'Acceleration des Trains. By C. O. Mailloux, E.E., M.S. Paris: Gauthier-Villars. 12 pages. Illustrated.

This is a reprint of a paper presented by Mr. C. O. Mailloux at the International Electrical Congress held in connection with the Marseilles Exposition of last year. It deals with the subject of speed-time curves, the principles and applications of which are set forth, and embodies a plea for the adoption of a practical unit of acceleration in terms of kilometer, hour and second, instead of meter-second-second. With the paper are printed comments thereon by M. R. Legouez and Prof. J. Blondin, editor of *La Revue Electrique*.

Princip und Wirkungsweise der Technischen Messinstrumente für Gleichstrom. By Fritz Hoppe. Leipzig: Johann Ambrosius Barth. 64 pages, 81 ills. Price, 2 marks, 70.

An elementary and practical text-book on direct-current ammeters, voltmeters, wattmeters and ohmmeters. It is written from the standpoint of engineering practice, using only elementary algebra with abundant diagrams and illustrations. The instruments considered are of the D'Arsonval, hot-wire, electrodynamometer and electrostatic types. The volume is well adapted to the use of students of electrical engineering taking up laboratory work.

Das Regulierproblem in der Elektrotecknik. By Dr. Ing. A. Schwaiger. Leipzig: B. G. Teubner. 102 pages, 28 ills. Price, paper, 2 marks, 80; linen, 3 marks, 60.

The engineering theory of machine regulation is developed in this book. The treatment is analytical, although the mathematics employed are not very difficult. The book is divided into three chapters. The first considers the general dynamical theory of direct-working regulators. The second deals with the corresponding theory of indirect-working regulators. The third chapter takes up the action of the Tirrill regulator. The book is clearly written and discusses its subject in a thoroughly exact manner. It is suitable for advanced students only.

Die Wasserkraftmaschinen. By A. v. Thering. Leipzig: B. G. Teubner. 118 pages, 73 ills. Price, 2.25 marks.

This little volume deals with modern water-power machinery in an interesting way, from a descriptive and comparative standpoint. Very little mathematical exposition is attempted, but it is endeavored to offer a clear conception of the methods of construction and of operation in various modern plants. Some data as to costs and economical comparison are given at the end which will be useful to engineering students.

Handbuch der Elektrischen Beleuchtung. By Herzog and Feldmann. Third edition. Berlin: Julius Springer. 766 pages, 707 ills. Price, 20 marks.

This is the third edition of a well-known work by the authors. The matter has, however, been largely recast and enlarged since the second edition appeared. The book is excellently presented, well illustrated and prepared for electrical engineering students specializing in the direction of electric lighting. For these it may well serve as a text-book, although there are a number of differences in detail between American and European practice. The work deals with electric lamps of all kinds, photometry, illumination, wiring and distribution, generators, generating stations, switchboards and installations. It will recommend itself highly to all students of electric lighting, especially those interested in European practice as presented in the German language.

DIE CHEMISCHEN STROMQUELLEN DER ELEKTRIZITÄT. By Dr. Curt Grimm. Munich: R. Oldenbourg. 201 pages, with appendix, 109 ills. Price, 6 marks.

This work is a strictly modern treatise on cells, both primary and secondary, containing concise and well-illustrated descriptions of all the more prominent batteries and many obsolete types, together with data on weight, capacity and discharge curves of the more prominent commercial types. American practice is not slighted, but, of course, where the Germans have developed similar types to our own, theirs is given preference. The thoroughness with which the subject is treated may be gathered from the titles of the 12 chapters composing the work: General theory; non-polarizable cells; completely depolarized cells; incompletely depolarized cells; dry cells; carbon cells and gas batteries; standard cells; lead accumulators; accumulator plates; accumulator construction; non-lead accumulators. An appendix is added to the work containing a list of all German patents of the past 15 years relating to cells and a bibliography of the chief works on the subject. It is the most modern and complete work on the subject of batteries and can be recommended to all interested in this branch of electrical science and application.

EINFÜHRUNG IN DIE MAXWELLSCHE THEORIE DER ELEKTRIZITÄT UND DES MAGNETISMUS. By Dr. Clemens Schaeffer. Leipzig: B. G. Teubner. 174 pages, 32 ills.

Maxwell's theory of electromagnetic wave propagation has received increased attention in recent years in view of the advances of wireless telegraphy and telephony. This little book, in the German language, forms an excellent introduction to that theory. As published by Maxwell himself, the theory was forbiddingly abstruse, being cast in such a form that only advanced mathematicians could follow it. Dr. Schaeffer has presented it in this book in such a manner that no extraordinary mathematical attainments are needed to grasp it.

The book opens with a fine frontispiece plate portrait of Clerk Maxwell. The treatment in the discussion is clear and logical. The book is of great interest to advanced students in physics and electrotechnics, giving the best elementary presentation of Maxwell's theory that we have yet seen.

NEW APPARATUS AND APPLIANCES

Protected Direct-Current Motor.

The British Thomson-Houston Company, Ltd., of Rugby, has brought out a line of protected direct-current machines, one of which is illustrated herewith. The standard machines are shunt and compound wound and are made in four styles. Attention has been given in the process of manufacture to the removal and permanent exclusion of moisture from the insulating material of the coils. The latter are subjected to a high potential test of alternating current at a pressure of 1500 volts applied between the coils and frame for a period of one minute, while the machine is hot. The armature core consists of laminations of sheet steel of high permeability slotted on the periphery to receive the windings and clamped under pressure between substantial end flanges. The cores are provided with radial ventilating ducts to allow of free circulation of air through the body of the armature. The teeth are supported by steel spacers. Form-wound coils are employed and secured by binding bands. The commutator has ample wearing depth and the shell, which is provided with ventilating ducts, is forced into position and keyed. A cast-iron magnet frame with poles of laminated steel is used and the field coils are wound on bobbins and held in position by the projecting pole tips. The bearings are carried either in end shields rigidly bolted to the frame or in pedestals. They are of the self-oiling type, lined with white metal and are self-aligning. The brushes are of carbon and are carried in brush holders of the clock-spring type, so constructed that the tension of any brush is uniform throughout the life of the brush and is readily adjusted without removing the brush from the commutator and without the use of any tool. The commutator end may be fitted with expanded metal covers, perforated metal covers, totally enclosing covers or enclosing ventilating covers with fan. By this means the motor can be applied to a variety of purposes without subjecting it to injury from iron chips, rain, water, paints, dust, etc.

PROTECTED MOTOR.

Transformer Fuse-Block.

The Pittsburgh Transformer Company has placed upon the market a new fuse-block which is furnished with the new Pittsburgh transformers. This block is of the plug and receptacle type and is all-porcelain. Very heavy and substantial construction is employed so that the block is durable and will handle short circuits or lightning discharges satisfactorily without breaking. An important improvement in the new block consists in finishing the same with a brown glaze which is fired on in the same manner as in the case of high-tension porcelain insulators. This brown glaze is, of course, permanent and greatly improves the insulating properties of the new fuse-block. Heretofore transformer fuse-blocks have usually been finished with a black paint or japan which very soon scaled off under the action of the weather, so that the porous porcelain became affected by moisture and dangerous to handle in wet weather. Furthermore, such painted fuse-blocks were very apt to ground upon the cross-arm and cause trouble. The all-glazed fuse-block described is claimed to possess many advantages over painted or japanned fuse-blocks, not only in point of safety and durability of finish, but also because its neat appearance is uneffected by the weather.

TRANSFORMER FUSE-BLOCK.

Electric Range.

The Westinghouse electric "Favorite" range, shown herewith, embodies a heating element which is claimed to combine in a high degree efficiency, simplicity and durability. The heating element is made of a practically indestructible material that converts the electric energy into heat at the exact point where it is wanted and in the most effective manner. It is so simple in construction that there is no possibility of its ever getting out of order or requiring repairs. The range corresponds in appearance with the most modern design of gas range. The cooking surface consists of six distinct heating units, each of which can be used independently of the other.

Both the oven and the broiler are located above the stove, so that no stooping is required. The oven is heated by five distinct heating units, so connected that any one or combination may be used without switching in the others. The broiler is heated by five units similar to the oven. This heating by separate units makes it possible to regulate the heat with great exactness and keep it at the temperature desired. Beneath the broiler is

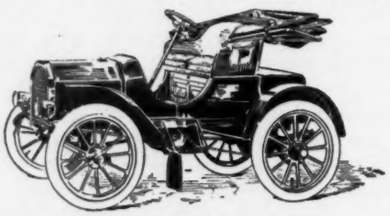
ELECTRIC RANGE.

located the reservoir, getting its heat from a double immersion coil. Under the cooking surface is an open plate warmer and beneath this is a shelf for cooking utensils. The combination is thus more complete than any gas range, as well as more convenient and practical.

The units in the oven and broiler are designed for 320 watts each, and those on the cooking surface for 500 watts each. The water heater takes 700 watts. All of the heating units are readily accessible for cleaning. The heat is always uniform so that cooking and baking can be done better and in less time than on another stove. As the range needs no chimney connection, it is not limited as to location.

Baker Electric Vehicles.

The line of electrics built by the Baker Motor Vehicle Company, of Cleveland, Ohio, embraces victorias, coupés, runabouts, roadsters, broughams, landaulets, surreys, stanhopes and commercial wagons. The general features of construction employed in the various pleasure vehicles do not vary widely so that a description of one is applicable to all. A series-wound motor capable of heavy overloads is employed in all of the vehicles, and Exide batteries are placed over the front and rear axles. The transmission from the motor to the rear wheels is by silent chain reduction, a single chain drive being used in the lighter vehicles and a shaft and beveled gear drive in



BAKER ELECTRIC RUNABOUT.

the heavy vehicles. The controller is of the continuous torque type, permitting six forward speeds and three reverse speeds on one lever, there being no extra reverse switch. The batteries are connected in series at all speeds, and four forward speeds of 12, 14, 16 and 20 miles per hour are obtained without resistance. By the use of annular ball bearings in all revolving parts the friction is reduced to the minimum and the general efficiency increased.

Combination Electric Vehicle.

In addition to seven designs of pleasure vehicles, the Studebaker Automobile Company, of South Bend, Ind., manufactures a line of electric commercial vehicles for all purposes. A combination passenger and merchandise-carrying vehicle mounted on the commercial-type running gear designed for normal-load service of from 1500 lb. to 2000 lb. is shown herewith. The body of this vehicle is equipped with removable seats, so that this type of machine may serve as follows: For electric-light companies, requiring emergency-service vehicles for the transfer of material or workmen; for mills and factories, located at a distance from railroad stations providing for the employment of this machine usually as a delivery wagon and occasionally for passenger transfer between factories and the railroads; for hotels, as either station or baggage wagon and for summer resorts as a sight-seeing vehicle. The running gear of this machine is provided with 42-in. driving wheels furnished with

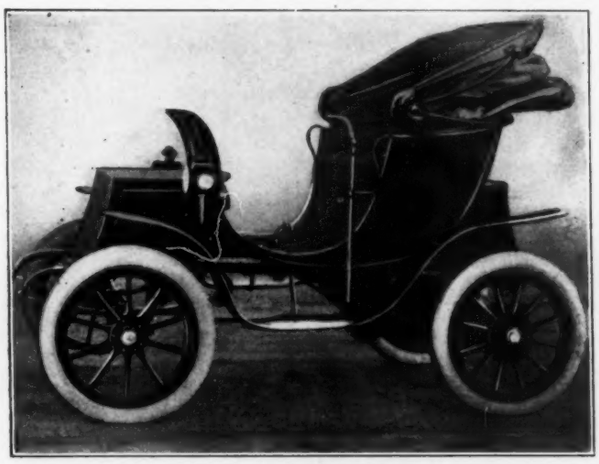
STUDEBAKER COMBINATION ELECTRIC VEHICLE.

independent Westinghouse motors; the large diameter insuring a reduction in power consumption; low tire maintenance and aiding in the easy riding qualities of the vehicle. The battery is suspended on supplementary springs within its compartment, thereby providing additional flexibility and minimizing the cost of maintenance. The lubrication is of the railroad waste-box

type now usually in use on street railways and considered to be absolutely reliable and requiring a minimum of attention. This running gear is said to exemplify the highest development of commercial vehicle design and the features mentioned are incorporated in all the larger sizes of vehicles now being manufactured by the Studebaker company.

Columbia Electric Victoria-Phaeton.

The Columbia electric victoria-phaeton manufactured by the Electric Vehicle Company, of Hartford, Conn., and illustrated herewith, embodies three important changes in the mechanism over previous models, although preserving the original outward design. These are an emergency brake worked on a drum on the motor countershaft in addition to the regular hub brake, the addition of two extra cells of battery and the use of Hess-Bright ball bearings in all four wheels. The body rests on four long semi-elliptical springs, and the motor and all mechanical parts are attached direct to the body. A reduction gear and enclosed chain connect the motor to the differential gear on the driven axle, which runs in a tubular casing, with all working parts housed to exclude dirt. The motor, which is of General Electric design, transmits its drive through a steel helical pinion and bronze helical gear to the countershaft, and thence by sprocket and chain to the rear axle. The controller provides four forwarding speeds of approximately 4, 7½, 12½



COLUMBIA ELECTRIC VICTORIA-PHAETON.

and 16 miles per hour, and two reverse speeds. On the second backward position of the lever the motor develops its maximum pulling power at a low speed. A feature is the double-acting brake on the rear hubs with brake surface sufficient to bring the carriage to a quick stop on any grade by a light pressure of the foot. As a further means of safety, a third brake acting on the drum on the motor countershaft, but entirely independent of the regular brake, is provided. This also operates by means of a foot pedal. All running gear is of the reachless type, with a single motor drive. The battery used is made up of 32 Exide cells in two trays, divided so that the weight is distributed equally over the front and rear axles. Under normal road conditions, with standard tires, the company says that it is easy to make from 50 to 60 miles per charge if the batteries are properly cared for.

Babcock Electric Carriages.

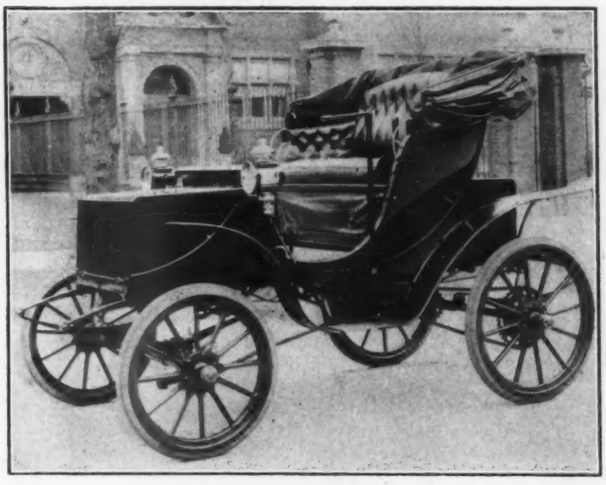
The Babcock Electric Carriage Company, of Buffalo, N. Y., manufactures a complete line of electric vehicles in which many original features are embodied. The batteries are built by the company, as is also the controller. A double chain drive is used on all but the town car, which has a worm drive. Friction is reduced to the minimum by ball and roller bearings, and lightness and graceful outlines are features of these cars. The weight of the battery is evenly divided over the front and rear wheels. An armored type of chassis is employed with a wheel base of 78 in. A powerful motor is suspended under the center of the chassis. A wheel-steering post with break joint so as to allow ingress to and egress from either side is a fea-

BABCOCK ELECTRIC VICTORIA.

ture of all the vehicles. Raymond brakes are provided in the hubs in the rear wheels and an auxiliary brake on the countershaft. The controller gives five forward and two reverse speeds; these speeds range from 6 to 25 miles per hour. The safety foot control is said to render accidents practically impossible.

Woods Electric Vehicles.

The Woods Motor Vehicle Company, of Chicago, Ill., manufactures a line of pleasure vehicles embodying many features which differ from regular practice. The vehicles are equipped with 40 cells of Exide battery and have solid rubber tires. Like other modern makes, each carriage is fitted with Hess-Bright ball bearings on wheels and motor and the transmission is one of the mechanical features of the cars. With the exception of the bearings, batteries, tires and raw materials, all parts of the



WOODS ELECTRIC VICTORIA.

Woods vehicles are made in its own factory. The motor frame is of Parsons manganese bronze, which gives maximum structural strength. A pinion on the motor shaft drives a large gear wheel mounted on the differential housing which is situated on the under side of the motor frame. Power is trans

mitted from each end of the bevel gear differential through a universal joint shaft to the driving sprockets and thence by chains to the rear axle. By the use of double helical or herringbone teeth on the pinion and differential gear wheel, smooth running is obtained. The sprocket ends of the shaft are mounted on outboard bearings, the housings of which are supported on short transverse studs, so that they can swing in the longitudinal direction of the car. Each outboard housing is connected to the rear axle by a distance rod made in two sections joined by a turnbuckle, so that the chain tension may be adjusted without destroying the axle adjustment. By this means the side drag on the tires is eliminated. A four-pole, series-wound motor, designed with regard to economy in energy consumption and to mechanical excellence, is employed. The controller is of the drum type and follows street railway practice. Flexible wiring and accessibility are features of the connections and the lamps and bell are connected permanently to wires away from the battery compartment operating under a tension of 40 volts. Four speeds are provided by change in battery and motor connections. A maximum speed of 19 miles per hour is attained under favorable conditions and a radius of action of 50 miles on a single charge. The brakes are two foot-operated inclosed expanded brakes, one on each rear hub and a band brake on a pulley mounted on the armature shaft. The latter brake is operated by a reverse motion of the controller handle and remains locked until released by a latch on this handle. A side-lever steer is employed.

Columbus Electric Victoria.

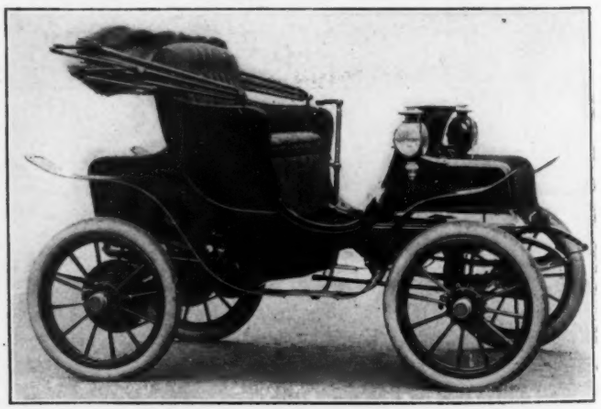
The power plant of the electric automobiles manufactured by the Columbus Buggy Company, of Columbus, Ohio, is mounted on a sub-frame attached to the chassis, which can be dropped from under the car, clear of the chassis, by the removal of four bolts. The battery is equally divided in the front and in the rear, giving the car a perfect balance. The motor is mounted above the springs; the object being to eliminate vibration which is always present when the motor is suspended on the axle.

COLUMBUS ELECTRIC VICTORIA.

Moreover, the motor is enclosed beneath the seat making a good running organization throughout the entire car. A noticeable feature is the absence of foot pedals; the one pedal with which the car is equipped being provided for emergency use only and not for regular service. The wheelbase is 74 in. and the gage 4 ft. 2 in. from center to center of the wheels. Four-in. tires are provided on the rear wheels for the reason that the power and brakes are both applied to the rear wheels and bring most of the weight upon them. Twenty-four cells of Exide battery, assembled in six trays, are ordinarily employed, and the speeds provided in the car range from five to 20 miles per hour. The four speeds are attained by a continuous forward motion of the controller handle. The controller board is fitted with self-cleaning contacts and the arrangement is such that the position of the controller handle is automatically enforced when starting and when changing speeds, making necessary full contact of the blades on the different speeds and preventing burnouts. The simplicity of the controller is one of the strong points claimed for the machine.

Rauch & Lang Electrics.

Electric carriages are built in a range of sizes and styles from the runabout, stanhope and victoria in the smaller open sizes, and the coupé in the inclosed, to the surrey, brougham and landaulet in the larger and heavier cars by the Rauch & Lang Carriage Company, of Cleveland, Ohio. While the appearance, size and style of the various cars are widely different, the general idea as to details of body construction, trimmings and mechanical design is the same throughout. The chassis consists of a cold pressed steel frame, to which all of the machinery, springs, axles and other parts are attached. This permits of a change of bodies to suit seasons. The axles are made of nickel steel and Timken roller bearings are used in the wheels, all joints in the steering gear being of the ball and socket type, spring cushioned and adjustable for wear so as to avoid rattle. Two side chains drive direct to the wheels mounted on a stationary rear axle and give not only great strength but flexibility of motion. All parts of the power plant in the vehicle are placed above the springs, thus protecting them against road shocks. The countershaft, motor, controller and controlling devices are mounted on a single manganese bronze casting or sub-frame so designed as to hold each securely in alignment with the others, adjustments being provided for all contingencies. This sub-frame is suspended as a unit from the steel frame at three points. Annular ball bearings are used throughout, and these combined with the silent chain used to transmit power from the motor to the countershaft give a unit power plant of high efficiency. The motor employed is of the multipolar type of the company's own design and is said to possess a very high efficiency over a wide speed range. The controller is of the continuous-torque type, giving six speeds forward and three reverse. A single lever is employed which locks with a Yale type key. Besides the speeds mentioned the lever combines two of the most important brakes and the signal bell. Exide batteries are divided and assembled into suitable receptacles located over the front and rear axles, and doors are provided in the hubs of the body so that they can be inspected and cared for or removed if desired. The battery equipment of the various cars is so related to their weights that under ordinary conditions a radius of action of from 50 to 70 miles is expected. The car is controlled with the right hand, which rests on a bar fitted with a hand grip. The safety lock controller handle is operated by the left hand and by moving it forward all running speeds are obtained, and on an extreme backward pull all of the power is shut off and the brakes applied. Immediately under the operating hand



RAUCH & LANG ELECTRIC VICTORIA.

is a device for opening and closing the circuit. When the car is being operated all power can be instantly shut off by a slight downward move of the hand and the circuit cannot be closed again until the handle has been brought back to brake position. A key must be inserted in the face of the handle and turned before it can be operated in any manner with the one exception that the handle can be used to apply the brakes at any or all times. This simple device displaces the plug used in many cases.

Broc Electric Carriages.

In the pleasure vehicles built by the Broc Carriage & Wagon Company, of Cleveland, Ohio, the frame is of pressed steel and the mechanical parts, including axles, springs, motor frame, motor, countershaft, controller, batteries, brakes and steering post are either suspended or anchored to the frame. The motor used is of the series-wound, General Electric type, rated at 2 hp and possessing a very large overload capacity. Each machine is supplied with 24 cells of Exide battery and a Renold silent chain reduction is employed from motor to countershaft, Whitney roller chains being used from the countershaft to the rear wheels. A controller of the continuous-torque type,

BROC ELECTRIC VICTORIA.

permitting five speed changes forward and reverse, from 5 to 20 miles per hour, forms part of the equipment. All speed changes are made without resistance and the design of the controller is such that freezing or welding of contacts is impossible. Hess-Bright annular ball bearings are used in mounting the armature shaft and also on the countershaft, and ball bearings are employed in both front and rear axles. The axles are constructed of nickel steel tubing and the rear hub brakes are of the internal expanding type with a specially designed locking device. The controller brake is of the positive friction type applied to the armature countershaft and easily operated by pulling the controller handle into a backward position. To prevent the insertion of the open-circuit plug in the socket except by deliberately throwing the controller handle back off of the neutral position a specially designed safety device is employed. A safety lock to prevent the theft of the machine is also provided.

Convention Exhibit Echoes.

In the June 3 issue of *Electrical World* a large number of descriptive notes were given with regard to exhibits at the Atlantic City convention of the National Electric Light Association on the new pier. These were prepared in the earlier part of the week and rushed through for that issue. A number of supplementary exhibit items of interest are now given below as to other features that attracted attention in the fine display:

RIDGWAY DYNAMO & ENGINE COMPANY was represented by Mr. Robert S. Beecher.

THE PHILADELPHIA STORAGE BATTERY COMPANY was represented by Mr. F. S. Marr.

THE H. T. PAISTE COMPANY, of Philadelphia, was represented by Mr. E. A. Jenkins.

MR. ROBERT E. MANLEY was looking after the interests of the Device Improvement Company, of Hanover, Pa.

OKONITE was represented by Messrs. George T. Manson and Romaine Mace, but was not made a separate exhibit.

HELIOS MANUFACTURING COMPANY, of Philadelphia, was represented by Mr. G. H. Rettew and Mr. Thomas Spencer.

H. H. CUDMORE, of the Brilliant Electric Company, Cleveland, was one of the busiest lamp men at the convention.

MR. JAS. G. BIDDLE, of Philadelphia, spent a day or two at Atlantic City with his many friends during the convention.

MR. JULIUS KRETZ was as usual looking after the interest of Walker & Kepler, of Philadelphia, among its many central-station friends.

MR. ARTHUR L. BOSLEY, general manager Lee Electric Company, of Baltimore, was present looking after the interests of his company.

INTERNATIONAL ELECTRIC METER COMPANY, of Chicago, was represented by its Eastern sales manager, Milton M. Kohn, of New York.

THE ELECTRIC SERVICE SUPPLIES COMPANY, with offices in all of the big cities, was represented by Mr. J. V. S. Titus and Mr. H. G. Lewis.

MR. N. L. NORRIS, the genial manager of the Banner Electric Company, Youngstown, Ohio, was on hand as usual, and up and doing every minute.

FOX BROTHERS COMPANY, of New York City, was represented by Messrs. H. T. Fox, H. C. Fox and F. F. Fox, as well as by Sales Manager G. A. Nisbet.

THE LINEMEN PROTECTOR COMPANY, of Detroit, Mich., manufacturers of a rubber shield for the protection of linemen, was represented by Mr. H. E. Marshall.

MR. FRANK M. HAWKINS, who represents the Crouse-Hinds Company, of Syracuse, in the New York district, was on hand as usual. He is among the "steadies" who rarely miss a convention.

MR. W. L. DEMING, of the Deming Company, Salem, Ohio, took advantage of this opportunity to visit Atlantic City and there extend his already large acquaintance among the electrical fraternity.

CHAS. WIRT & COMPANY, of Philadelphia, manufacturers of the Dim-a-Lite turn-down socket, was represented by Mr. Chas. Wirt himself. The apparatus is so handy a vest pocket is a good exhibition space.

G. I. LAMP COMPANY.—No convention would be complete without Harry Curtis Rice, of the General Incandescent Lamp Company, Cleveland. There was no question about this convention being complete.

MR. T. J. COPE, of Philadelphia, spent Wednesday at the convention and reported that during the past month he had booked more orders than at any time during the past year for his specialties in drawing-in apparatus, etc.

THE JANDUS ELECTRIC COMPANY, Cleveland, was represented by Messrs. L. C. Eshleman, secretary; Arthur Organ, New York representative, and G. A. Rumsey and L. J. Costa, of the Rumsey Electric Company, the Philadelphia agency.

DUNCAN ELECTRIC MANUFACTURING COMPANY, of Lafayette, exhibited a new multiple astatic switchboard meter showing an ideal and convenient arrangement for disconnecting the armature and removing it from within the field coils.

MR. HENRY J. BLAKESLEE, Syracuse, N. Y., exhibited for the first time his "Phantom Load" for alternating-current meters. The compactness and great convenience of this device appealed to the central-station men, and elicited much favorable comment.

EXCELLO ARC LAMP COMPANY, of New York, was represented by Messrs. A. J. Thompson, secretary, and G. W. Armstrong, Western manager. For the first time in some years Mr.

Hirschberg, the president of the company, was unable to attend, as he is abroad this summer.

Mr. Geo. L. Rowland, of James J. Murray & Company, Philadelphia, spent Wednesday and Thursday at the convention with his many friends in the central-station field who have used the Murray glassware for lamps for many years. Mr. Thos. V. Loughran also represented the firm.

The Locke Insulator Manufacturing Company, Victor, N. Y., had a fine exhibit of its well-known "Victor" high-tension insulators in the Pettingell-Andrews booth. Besides the more usual types of line insulators, tubes, etc., several large specimens of the suspension type were shown.

Mr. Milton Roach, formerly passenger agent of the New York Central, made a very welcome contribution to the comfort of the passengers on the special train to Atlantic City over the Pennsylvania Railroad by furnishing a large quantity of well-iced "Sunray" from his springs at Ellensville. The warm day made it very acceptable.

The Electrical Concrete Company, of Chicago, showed samples of "Electrete" products. This material is a cement composition which can be molded into barriers, compartments, insulators, cable terminal bells and other insulating articles. The exhibit was made in the booth of the Minerallac Electric Company in charge of Mr. A. Wakefield.

Habirshaw.—The interests of the Habirshaw Wire Company were looked after by Secretary J. B. Olson, who very rarely misses a convention. It is worthy of note that the report of the convention committee on memorials paid a high tribute to the technical standing and reputation of the late Dr. W. M. Habirshaw, who died during the year.

The Diamond Rubber Company, Akron, Ohio, had an interesting exhibit of rubber-covered wires and cables, rubber-insulated lead-encased cables, and igniter cables. These were all shown in great variety and small samples were distributed to visitors. The booth and exhibit were in charge of Mr. H. R. Sharkey, of New York, its Eastern representative.

The Central Laboratory Supply Company, of Lafayette, Ind., exhibited a portable graphic recording direct-current voltmeter and a combined edgewise indicating and graphic recording alternating-current voltmeter. The exhibit was in the booth of the Duncan Electric Manufacturing Company. Adrian Tobias and Wm. H. Sinks were in attendance.

The Adams-Bagnall Electric Company, Cleveland, exhibited its new regenerative flaming-arc lamp in the Price-McKinlock booth. The many new features of this lamp attracted much attention. The Adams-Bagnall Company was represented by A. J. Mitchell, of the home office; J. G. Pomeroy, Chicago, and G. A. Thompson, Eastern sales manager.

When the Chicago special train reached Harrisburg early on the morning of May 31, every man on the train received a message typewritten on a regular telegraph blank and enclosed in a yellow telegraph envelope. These "telegrams," addressed in care "Opalux Flyer," called attention to the "Opalux" reflectors used on the train, and to the display of these devices at the convention exhibition.

Mr. W. B. McVicker, president of the W. B. McVicker Company, could not exhibit his chemical engineering at the convention, but he held a reception Wednesday and Thursday afternoons at his room at the Marlboro-Blenheim at which souvenirs were distributed to his guests. The souvenirs consisted of imported jewel-cases, vases, flower-holders, candelabras, drawings, water-colors, and other objets d'art.

Buckeye Lamps.—It is needless to say that L. P. Sawyer, of the Buckeye Electric Company, Cleveland, was very much in evidence all through the convention. J. M. Smith and Mr. Conley, the Philadelphia representative, assisted him in waging "The Battle for Business." In the baseball game, "East v. West," Mr. Sawyer, as catcher for the West, had the misfortune to get a split finger and was taken off the grounds in an automobile. With a bandaged hand he was still "in the ring," if not "on the diamond."

The Rochester Electric & Insulation Company, Rochester, N. Y., exhibited the McDonald subway test block, a device which does away with cutting and splicing cables when making tests, and is a great time and money saver. Another device which attracted much attention was the new telephone protector. This is so constructed that if the fuse blows out, it is impossible to substitute a piece of wire. The only renewal possible is the fuse made for this purpose. The exhibit was in charge of P. J. McDonald, the president of the company and the inventor of these devices.

Westinghouse Literature was an exhibition in itself, and was in general demand. Apart from its excellence in getup, there was an attractiveness about its data and discussion of things that made central-station managers want to take it home. The booth was crowded all the time with applicants. A particularly effective folder was that devoted to the new Westinghouse electric range, which comprises several devices for cooking, heating, etc., in one, making it a really "hot" competitor of the gas range. But equally in demand were the brochures and bulletins devoted to fan motors, electric power for domestic purposes and the "general utility" sewing-machine motor.

Souvenirs were quite conspicuous by their absence this year, which was rather disappointing to those who with a fine scent spend part of their time at a convention hunting down the elusive article. One of the few given out, and it might be said the best, was that of the Wagner Electric Manufacturing Company. It consisted of dainty boxes of Huyler chocolates, labeled "Wagner Quality," and was much appreciated. Owing to the block of the holiday of Decoration Day, the boxes did not arrive until very late on the final day, without exterior covers or labels, and then some 400 or 500 of them had to be distributed in a rush to the various hotels. Where it was impossible to make direct delivery, the box was sent on by mail to the best address obtainable from the registry list. It was a neat piece of work, and the candy will doubtless be more appreciated, even in the retrospect, when this item is read.

The Minerallac Electric Company exhibited the "G. & W." line of potheads, or terminals for cables and subway boxes. A very attractive addition to this line is a large high-tension pothead for use on lines with a potential of 10,000 to 30,000 volts. The new subway boxes were shown, for either single or multiple conductors, comprising a combination subway junction box and pothead. The important features are: Filling the lower half of the box with compound; and its inverted-belt lid, which eliminates the possibility of the entrance of moisture into the boxes when entirely submerged. A large three-conductor fusible box was on exhibition designed for half-taps, which included these features. The G. & W. Company has recently issued a new and attractive catalog which was distributed, showing some typical installations of its products in several large plants in this country. Altogether nine types of potheads and four types of subway boxes were shown, attracting interest quite beyond the usual. Mr. A. Wakefield, of the Chicago office, was in charge.

The Stave Electrical Company exhibited outside the pier two of its new type vertical flaming-arc lamps, which dared the sunlight and attracted a great deal of attention. These lamps are 2500 cp, 350 watts, burning three in series on 110 volts at a current of 10 amp. They burn 26 to 28 hours. They give a bright white light and are particularly well adapted to street illumination. These lamps have recently been adopted by the city of Berlin, Germany. In the booth were on exhibition the Stave regular type flaming arcs, which were shown in such a manner as to illustrate admirably the accuracy of the feed, and the mechanism of the parts handled by the trimmer, in demonstration of the claim made for them of being "fool-proof." The miniature arc-lamp known by the trade name "Stavelco," which is suitable for store lighting, was also shown. A series of photographs was exhibited showing the different appliances of flaming-arc lamps in some important installations. In the convention hall were two Stave flaming arcs burning on the difficult 133-cycle circuit with great success. The exhibits were in charge of Mr. Theodore Stave, president, and Mr. Batterman, general sales manager of the company.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

One of the most striking features in the week's trade report is the remarkable activity in the building industry. The actual returns made by 62 of the principal cities for the month of May, as compiled by *Bradstreet's*, shows that there were issued permits for $68,480,397 during the month, as compared with $60,870,557 in April and with $36,073,823 in May last year. This is an increase of 89.8 per cent over last year's record. This record of activity means much to the electrical business because the present boom in building is largely in the direction of large structures for business purposes. It is probably not an exaggeration to assert that there is more high-class fireproof building projected at this time than ever before reported. The cheapness of structural material and the easy money market are responsible for this condition. Comparatively, steel and cement have been much cheaper than lumber, and the improvement in the character of buildings projected is a natural sequence. Outside of this feature it may be noted that there is a continuation of the gradual improvement in trade that has been observed for the past two months. Warm, moist weather throughout the West has improved the crop condition to a marked degree. While wheat and cotton acreages show small reductions from last year, the corn acreage is a record breaker and the crop has been given a most excellent start. Retail business is steadily expanding. The present prosperity among the farmers and the promise of future prosperity have done much to stimulate buying. The spring clearance sales, which for the most part are about over, have been very satisfactory, and the regular summer business is making a much better showing than last year. In the wholesale and jobbing business there is little doing. This, however, is the dull season for this branch of trade, and the fact that only reorders and filling-in orders are being received causes no discouragement. In the industrial field, and especially in the iron and steel industries, there continues to be a great awakening of activity. It is said that the product of finished steel materials for the month of May surpassed that of the same month in any previous year. The mills are now employed at full time, and while the prices for the finished product are less than they formerly were, raw material and labor are both reduced to some extent and the business will show a profit. Collections, while somewhat better than a few months ago, are still regarded as only fair. This in a measure is due to the strong sentiment of conservatism that has been developed in the business world. Many who have the money to pay prefer to let their accounts run rather than leave themselves without ready cash. Failures for the week ended June 3 as reported by *Bradstreet's* were 191, compared to 205 the previous week, 225 in the like week of 1908, 155 in 1907, 162 in 1906 and 194 in 1905.

THE COPPER MARKET.

Those consumers of copper who have failed to provide for their June and July requirements up to this time are finding the prices advanced. During the past week there was an advance of one-quarter cent per pound on all grades of copper, and even at this advance there was some reluctance on the part of producers and selling agencies to accept large orders for future delivery. The condition of the market is such that there is no pessimism to be found among any of the producers. During the past week the report of the United States Geological Survey for the year 1908 was made public. This report shows that there was a total output of refined copper in the United States for the year of 1,094,700,123 lb. The production of the mines of the United States, according to the smelter reports, was 942,570,721 lb., which is the largest production ever made, exceeding that of 1906 by 24,765,039 lb., and that of 1907 by 73,574,230 lb. According to the United States report the consumption of copper during the year was 479,954,318 lb. The Government figures of the stocks of refined copper on hand Jan. 1, 1909, in the hands of refiners and producers, were 121,876,759 lb. This is a slight reduction over the Government's figures of the year previous. It is generally considered, from these figures that there must be considerable amounts of copper now in the hands of consumers. The takings of almost 480,000,000 lb. are within a few million pounds of the takings of the previous year. It is known, however, that the actual consumption by melters in 1908 was not more than 70 per cent of what it was during the previous year, indicating that not more than 400,000,000 lb. actually went into consumption. This would indicate that the consumers are now carrying about 80,000,000 lb. With the reports in the present uncertain condition, it is difficult to estimate the actual surplus stock of copper now in this country. It is known that during the past five months there have been considerable accumulations, and one statistician in the local market figures that stocks on hand in this country now amount to 342,000,000 lb. These figures are ridiculed by the producers and selling agencies. Buying during the week, both for foreign and domestic accounts, has been fairly active. Exports since the first of June have been 10,479 tons. Quotations on the New York Metal Exchange June 7 were:

Lake	13⅝ @ 13¾
Electrolytic	13⅜ @ 13½
Casting	13¼ @ 13⅜

The London prices June 7 were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	61 15 0	61 7 6
Standard copper, futures	62 10 0	62 5 0
Market	Firm	Easy
Sales of spot		700 tons
Sales of futures		2,400 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	.....	.....
Lake	14.55	12.55
Electrolytic	14.25	12.12½
Casting	14.12½	12.00
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	55 10 0
London, best selected	67 15 0	59 0 0

WESTINGHOUSE COMPANY EXTENDING ITS PLANT.—The Westinghouse Electric & Manufacturing Company has just purchased from the East Pittsburgh Improvement Company 43 lots or about 1,900 ft. frontage on Turtle Creek adjoining the present factory site at Wilmerding, Pa. The land extends to the Turtle Creek Valley railroad and the Westinghouse Inter-Works railroad and is the only railroad frontage adjoining the factory sites of the electric and air brake companies. The land was deemed necessary for the proper extension of the company's yard system, which has been cramped since the last additions were made to the factory buildings and power house some two years ago. The purchase was decided upon before the company went into the hands of a receiver, but was necessarily delayed until the financial affairs of the company were straightened out. The present activity and the present prospects of the company warranted the completion of the extension as originally planned.

CONSULAR CARD INDEX OF MANUFACTURERS.—The Bureau of Manufactures of the Department of Commerce and Labor has arranged for filing with United States consuls a card index whereby the consulates may forward the export of American goods. Major John M. Carson, chief of the Bureau of Manufactures, announces that any manufacturer desiring to take advantage of the plan should communicate with him. No fee is to be charged for the service in sending out cards to the consulates. All that is required of the manufacturer is that he print his cards in the language of the country to which they are sent, and in a prescribed and uniform size for assembling.

CROCKER-WHEELER-BULLOCK LITIGATION. — A jury in the United States Circuit Court at Trenton, N. J., after a trial of 10 days, rendered a verdict for $6,403 in a suit for $500,000 instituted by the Crocker-Wheeler Company against George Bullock for failure to sell to the former his controlling interest in the Bullock Electric Manufacturing Company. During the trial the judge ruled that the Crocker-Wheeler Company was not entitled to recover for anticipated profits resulting from the proposed purchase of the Bullock company, thereby reducing the claims made by the plaintiff by $460,000.

GARWOOD ELECTRIC COMPANY.—In the issue of May 6 mention was made of the Garwood Electric Company, organized under the laws of New Jersey, and capitalized at $250,000, which took over the business and patents of the C & C Electric Company. The entire management of the Garwood company is in the hands of men who have a thorough knowledge of the electrical business in all of its branches. The directors are: William B. Elliott, president and acting treasurer; D. W. Barnes, C. H. Florandin, vice-presidents; Bernardo Ulmer, secretary, and Gustavus T. Kirby. Mr. Elliott has been connected in various capacities with the C & C Electric Company during the past 22 years as superintendent, works manager and general manager. Mr. Florandin has been associated with the same company during the past 14 years as purchasing agent and manager of its New York office. He was previously connected with the operating and engineering departments of the Brooklyn Heights Railroad Company. Mr. Barnes was formerly connected with the engineering department of the E. W. Bliss Company. His association with the C & C Electric Company dates back some 18 years, 15 of which he served in an engineering capacity at the works. During the past eight years he has been connected with the New York office. Mr. Ulmer has been connected with the C & C company during the past 12 years in various capacities and as assistant to general manager. Mr. Kirby, of Kirby & Wood, New York, has had considerable experience in the manufacturing line. The new company paid all of its $250,000, of capital stock, for the properties purchased and its assets are said to be far in excess of the amount paid. No cash went with the properties purchased, and the proceeds from the outside sale of stock is entirely for working capital. More than 90 per cent of the salesmen, engineers, office force, foremen, mechanics and other employees have become stockholders in the new company. The company's plant, which covers 5½ acres, is well equipped and is located at Garwood, N. J., 17 miles from New York. The company will continue the manufacture of the dynamos, motors and other appliances formerly manufactured by the C & C company, which have been on the market nearly 26 years. It will also pay special attention to the manufacture of electrical apparatus used in connection with modern heating and ventilating plants, to its line of special motors for driving large newspaper presses and to its system of electric welding. The New York office is at 149 Broadway.

LOW-PRESSURE TURBINES IN THE LUMBER INDUSTRY.—The Potlach Lumber Company, at Potlach, Idaho, has recently installed a Westinghouse low-pressure turbine of 600-kw capacity that will use the exhaust steam from the company's power plant now in operation. There are now at this plant one rope-driven Corliss engine and a 100-kw high-speed triple engine driving a generator. The low-pressure turbine will take steam at about 15 lb. pressure from both these units. The new unit will be used for lighting the town and the mill. The new equipment ordered includes a Westinghouse Le Blanc condenser for carrying a 28-in. vacuum. The entire fuel used under the boilers at this plant is refuse from the saw mill. The work of the exhaust turbine is being appreciated by every line of industry. The Westinghouse company has recently installed similar equipments for the Pressed Steel Car Company, Pittsburgh, and the American Iron & Steel Company, of Lebanon, Pa.

CUBAN CONTRACT FOR CABLE.—A resolution has been adopted by the Cuban Government authorizing the Director-General of the Post Office and Telegraph departments to contract for 10 miles of submarine cable, to establish telegraphic and telephonic communication between Cayo Christo and la Isabele de Sagua. The necessary appropriation for this purchase amounting to $8,250, has also been authorized and charged to the budget. The fact that the resolution authorizing this expenditure expressly states that the Director-General may contract, "without the formality of public bids, and without requiring bonds from the contractor" has caused some criticism among firms engaged in the Cuban trade in this country. It is claimed that this method of doing business is to favor a German contractor of Havana, who is a great friend of the President of Cuba, and entirely cuts out any competition from American firms. It is rumored that a protest may probably be sent to Washington.

WESTINGHOUSE TURBINES IN DETROIT.—The Detroit United Railways recently placed a contract with the Westinghouse Machine Company for another turbine unit. This company already operates Westinghouse turbines in three of its power stations. The new turbine, which is 1000 kw and is to operate at 150 lb. steam, 28 in. vacuum and saturated steam, will be installed at the Rochester station on the Detroit and Flint division. This station already contains engine type units but extensions of traffic have necessitated the installation of this new turbine unit. The Flint division is about 62 miles in length with central station at Rochester and substations at intervening points and operates heavy, high-speed interurban cars, reaching the center of Detroit over the city lines. The system is operated by high-tension alternating current transmission, originally supplied through inverted rotaries, but with the installation of the new unit direct from the turbo generator. The direct current equipment will then be used for feeding directly into local sections of the distributing system while the alternating current machine will carry the outlying portions of the line load.

DEMAND FOR LEAD CONTINUES HEAVY.—A director of the American Smelting & Refining Company says that the business of that concern continues to be very good. He says that the demand for lead is as heavy as ever in the history of the company, and that the copper metal situation is greatly improved. It is said that the immediate call for lead, both in the manufacturing business and by the paint makers, is so great that the company is having difficulty in filling all of its orders. All of the plants producing lead are running at full capacity, and there are still many orders that cannot be immediately filled. The earnings of the company are fully up to expectations, and the regular dividends will undoubtedly be declared. Copper plants are being operated at the present time upon a basis of 80 per cent, whereas a few months ago they were only running on a basis of 60 per cent.

ELECTRICAL CONSTRUCTION.—Among the items printed under Construction Notes in the present issue are announcements of proposed new plants or considerable extensions of present plants at Westfield, Mass.; Tilton, N. H.; Galveston, Tex.; Saskatoon, Sask., Can.; Palacious, Tex.; North Yakima, Wash.; Thersea, N. Y.; Grand Prairie, Tex.; Atlanta, Ga.; Caro, Tex.; North Adams, Mass.; Blackwell, Okla.; Copper Creek, Ariz.; Vancouver, B. C., Can.; Willimantic, Conn.; Kalispell, Mont.; Ukiah, Cal.; Providence, R. I.; Henning, Ill.; Tucson, Ariz.; Logan, Utah; Louisville, Ky.; Ellwood, Pa.; Noosack, Wash.; Fairfield, Ia.; Gregory, Tex.; Park City, Utah; Evansville, Wis.; Delphos, Kan.; University, Mo.; San Francisco, Cal.; Kenosha, Wis.; Prince Albert, Sask., Can.; Gouverneur, N. Y., and Searcy, Ark.

MILLIKEN BROTHERS REORGANIZATION PLAN.—The reorganization committee of Milliken Brothers has adopted a plan by which it is hoped that it will not be necessary to raise any additional capital. It is proposed that by putting the company's entire plant into operation enough profit will accrue to provide for the payment of all the outstanding obligations. It is not expected that it will be necessary to scale down either the capital stock or the bonded indebtedness. The company was placed in the hands of receivers in June, 1907. The receivers have not only succeeded in paying the interest on the $3,000,000 bonds but have accumulated a cash balance of $500,000.

DEVELOPMENT ON THE SAVANNAH RIVER.—The Twin-City Power Company is the name of a concern that has undertaken the development of the Savannah River, at Price's Island. The work has been commenced by the construction of a concrete dam that will cost between $3,000,000 and $4,000,000. The watershed for this dam extends back for 20 miles and it is believed that with a system of reservoirs there will never be any lack of water on account of dry weather. The company will operate an electric railway from Modoc, S. C., to the plant. It is expected that the plant will supply light and power to towns and cotton mills within a radius of 50 miles.

FEDERAL POWER SITES WITHDRAWN.—Acting under instructions from the Secretary of the Interior, the director of the United States Geological Survey has recommended the withdrawal of 11 water power sites on the public domain. These withdrawals aggregate 236,365 acres of public land in Utah, Colorado, Wyoming, Montana, Idaho and Oregon. Some of the more important sites withdrawn were upon the Salmon River in Idaho; the Owyhee River in Oregon, and upon the Flathead and Missouri, and their tributaries, in Montana.

MICA IMPORTS MUCH SMALLER.—The Geological Survey report for 1908 shows that the total domestic production of mica was 972,964 lb., valued at $234,021, which is a decrease of 87,218 lb. and $115,290 from 1907. The value of the imports into the United States fell off from $925,259 in 1907 to $266,058 in 1908. Speaking of these figures an importer and dealer in mica had this to say: "While the government report shows that the imports, for the first time in the history of the mica trade, have fallen below in value the domestic production, this condition has nothing to do with the tariff. Neither the high protection that is now given the domestic producer, nor the proposed rate that was adopted in the amended tariff bill by the House, is responsible for producing more mica than we imported. This is merely a condition of trade. During the depressed manufacturing times of 1908 there was very much less demand for mica than at any time in recent years. Just as soon as electrical manufacturing gets back to normal conditions the demand for mica will increase, and the majority of this mica will have to be imported. As pointed out in your columns heretofore, the manufacturers believe that the new rate of 5 cents per pound and 20 per cent ad valorem on uncut mica, and 10 cents and 20 per cent on manufactured mica, is a hardship upon the consumers in this country, and we do not believe that the domestic producers need this amount of protection. The duty mostly falls upon qualities of mica that cannot be produced in this country under any circumstances. This makes the consumer pay a tax upon a commodity which must be purchased abroad. In ordinary times the value of imported mica is about four times the value of domestic mica."

ISTHMIAN CANAL PURCHASE.—Bids have been asked for by the general purchasing officer of the Isthmian Canal Commission at Washington, to be opened June 21, for several surface condenser pumps, packing, pipe covering, brass and copper tubing and copper wire.

Financial Intelligence.

THE WEEK IN WALL STREET.

There is no denying the fact that the activity in steel issues was the feature of the stock market during the past week. This was not only apparent in the fact that the two stocks of the United States Steel Corporation led in the advance movement of the week, but in the fact that all of the independents also showed considerable gain. The remarkable activity in the industrial steel business would necessarily be reflected in the steel stocks. It is hardly correct, however, to say that the striking advance in steel common is entirely attributable to the industrial activity. For many months there has been a persistent and constant tip that steel common would before the middle of fall sell at 75. This has been laughed at, and also has been believed, and the advance of last week shows that it is not at all beyond the realm of the reasonable. Steel common to-day paying 2 per cent would actually be worth as an investment security less than 50. The business of the corporation, however, and the promises of future business indicate that the common stock may reasonably expect to earn a 5 per cent dividend in the near future. It took a long time for the investing public to appreciate the fact that steel preferred was a good security. For many years, while this stock paid 7 per cent, it was below par. At the present time it begins to be apparent that the public understands that the preferred dividend is reliable, and that on a proper basis the stock should be worth considerably above par. The buying of preferred last week, which advanced the quotations 5⅞ points, was principally from investors. Outside of the iron and steel issues in the market last week everything was more or less strong, Amalgamated Copper, for instance, made an advance of more than 2 points, which is considerable when it is known that the advance of copper metal was only a fraction of a cent. All of the industrials were notably active. American Locomotive common advanced more than 3 points, and the preferred almost 2 points. The Mackey securities advanced more than 3 points for the common, while the preferred showed a small advance. General Electric advanced 2 points, and New York & New Jersey Telephone was in greater demand than it has been for a number of weeks. Taken altogether, the stock market during the past week is one of the best we have had since the time of depression. There were almost 6,000,000 shares sold during the week, and in almost every instance the net change was an advance. One of the features of the week which is particularly interesting, in any review of the market, is the fact that outsiders appeared to be buying. From the start to the finish commission houses had orders from investors, and possibly from speculators, who wanted to buy stocks. In many instances these orders were sent in with a limit that prevented their execution in the open market. This in itself shows that the outsiders believe in the advance of the market, but were not willing to take the chances of getting in at top figures. In the meantime, the bond the money market has been remarkably easy; there has been no trouble about placing bonds, and every issue that has been offered has been over-subscribed. The money market has been as easy as for several months past, and the evidences that the banks are overstocked with cash are still with us. Call money on June 7 was 1½ @ 2 per cent, and 90-day paper could be had at 2¾ @ 3 per cent. The quotations in the table are of the close June 7.

NEW YORK.

	May 28.	June 7.	Shares sold.		May 28.	June 7.	Shares sold.
All.-Ch.	16	15¼	1,600	Int.-Met., pfd.	46	45¼	26,250
All.-Ch. pfd..	52¼	52⅜	3,000	Mackay Cos...	79¾	82⅜	7,500
Amal. Cop....	85¼	87	131,590	M'c'ky Cs., p..	73⅞	74¾	1,400
Am. D. T.....	29*	29*	.....	Man. Elev...	147	146½*	400
Am. Loc.....	58⅞	61⅝	24,500	Met. St. Ry..	27*	29*	1,100
Am. Loc. pfd.	115*	117	1,400	N.Y. & N.J.Tel.	123*	124	300
Am. Tel.&Cbl..	77¾*	79	.....	Steel, com....	64⅜	67¼	729,687
Am. T. & T..	140⅜	140⅝	11,980	Steel, pfd.....	120	125	108,795
B. R. T.....	79½	81¼	66,175	W. U. T.....	75¼	76½	4,125
Gen. Elec.....	160¾	160	8,900	West'h. com...	83¾	85	13,350
Int.-Met. com.	16½	16½	19,248	West'h. pfd...	121	123	300

PHILADELPHIA.

	May 28.	June 7.	Shares sold.		May 28.	June 7.	Shares sold.
Am. Rys.....	45¾*	45¾	.....	Phila. Elec...	12	11⅞	.....
Elec. Co. of A.	12½	12½	.....	Phila. R. T...	33⅛	32	.....
Elec. St. B'ty.	48½	52½	.....	Phila. Trac...	92⅜*	92*	.....
E. S. B'ty, pfd.	49*	49*	.....	Union Trac...	56¾*	56¼	.....

CHICAGO.

	May 28.	June 7.	Shares sold.		May 28.	June 7.	Shares sold.
Chi. City Ry..	180*	180*	.....	Chi. Tel. Co..	133	133¼	.....
Chi. Rs., Ser.1.	109½*	107½	.....	Met. El., com.	19*	19*	.....
Chi. Rs., Ser.2.	38½*	38½	.....	Met. El., pfd.	50*	54*	.....
Com. Edison..	119½	119½	.....	Nat'l Carbon..	87*	93	.....
Chi. Sub'ys...	26	24½	.....	Nat'l C., pfd..	119*	119*	.....

BOSTON.

	May 28.	June 7.	Shares sold.		May 28.	June 7.	Shares sold.
Am. T. & T..	140¼	140⅜	.....	Mex. Tel.....	3*	3*	.....
Cum. Tel.....	136*	136¼	.....	Mex. Tel., pf.	5½*	5½*	.....
Edison, E. Ill..	249	248	.....	N. E. Tel....	132¾	133	.....
Gen. Elec.....	161¼	160	.....	W. T. & T...	12	11¾	.....
Mass. E. Ry..	12½	12½	.....	W. T. & T., p.	87*	87*	.....
Mass. E. R., p.	69½	67½	.....				

*Last price quoted.
Shares sold are for week June 1 to June 5.

DIVIDENDS.

American Smelting & Refining Company, quarterly, common, 1 per cent, payable July 15; preferred, quarterly, 1¾ per cent, payable July 1.

Canadian General Electric Company, Ltd., common, quarterly, 1¾ per cent, payable July 1.

Interborough Rapid Transit Company, quarterly, 2¼ per cent, payable July 1.

Portland (Ore.) Railway, Light & Power Company, preferred, quarterly, 1¼ per cent, payable June 15.

Safety Car Heating & Lighting Company, quarterly, 2 per cent, payable July 1.

APPLICATION FOR RECEIVER FOR RAILWAY AND LIGHT COMPANY.—A bill in equity has been filed with the Supreme Court at Augusta, Maine, asking for the restoration to the stockholders of the property of the Waterville & Fairfield Railway & Light Company, Waterville, Maine, and for the appointment of a receiver to take charge of the affairs of the company. A hearing has been ordered to be held July 6. It is alleged that interest on $75,000 in bonds has not been paid.

PETITION FOR APPOINTMENT OF RECEIVER.—Dane A. Pearson, claiming to represent the majority of stockholders, has brought a suit in the United States Circuit Court asking for a receiver for the Citizens' Electric Light, Heat & Power Company, of Altoona, Pa., and an injunction restraining the directors from rescinding its contract with the Juniata Water & Power Company.

METROPOLITAN STREET RAILWAY CERTIFICATES.—The New York City Railway and the Metropolitan Street Railway have sold to William A. Read & Company a new issue of $3,500,000 receiver's certificates. These certificates are prior liens, and are issued to take up an equal amount of notes maturing June 15. They are being offered to the public at 100¼.

MONTREAL LIGHT, HEAT & POWER COMPANY.—The annual report of the Montreal Light, Heat & Power Company for the fiscal year, which ended April 30, 1909, shows that the gross revenue of the company was $4,079,769, and that the net profits, after paying fixed charges, were $1,745,847. During the year there was charged for depreciation $393,380, and a charge of $25,000 was added to the insurance fund. This liberal amount charged to depreciation emphasizes the strong financial basis of the company. According to the report of President H. S. Holt the company added two large gas holders and a considerable amount of trunk mains to its gas equipment, and also constructed upward of 30 miles addition to its conduit system, and approximately 10 miles to its cable system. As a consequence of these additions a large amount of overhead lines have been discontinued and taken down. It is the policy of the company to further extend the underground system, and even at this time all of the congested districts of the city are practically free from overhead wires. Additions in the way of new business, both in the gas and electric departments, are reported as thoroughly satisfactory.

AMALGAMATED COPPER COMPANY'S REPORT.—The annual report of the Amalgamated Copper Company for the fiscal year ended June 30, 1909, shows that the net earnings of the company were only $3,663,000. This compares with net earnings of $14,154,000 in 1906, and $6,680,000 in 1907. The net earnings shown in the report are barely enough to pay the 2¼ per cent dividend on the company's capital stock. In the meantime, the company has produced during the year more copper than ever before in its history, the total amount, according to the report, being 234,000,000 lb. In speaking of the physical condition of the company's plants, the report points to the fact that a number of improvements and extensions are being carried forward, among them being the installation of electric pumps and other electrical devices. It also states that investigations are now being made to determine the feasibility and economy of operating all the hoisting plants of the company by compressed air generated by electric power. At the annual meeting J. Horace Harding and James Jourdan were elected directors to succeed the late A. R. Flower and the late H. H. Rogers.

NIAGARA FALLS POWER COMPANIES.—At the meeting of the Niagara Falls Power Company and its subsidiary the Canadian Niagara Power Company on June 1, in addition to authorizing a $25,000,000 bond issue, as stated in the last issue, the old boards of directors were re-elected. In the former company Charles D. Dickey, of New York, was chosen to fill a vacancy in the board. The only portion of the new bond issue that will be put out at this time is $9,075,000 required for refunding purposes. The remainder will be issued from time to time as money is required for improvements and extensions. The security for these bonds will be the entire issue of bonds by the Canadian Niagara Power Company, secured by a first mortgage on its plant and distribution system and a mortgage on some 1100 acres of land suitable for manufacturing sites and all the plants and distribution systems of the Niagara Falls Power Company. The only prior lien on the property is that securing the issue of $10,000,000, 5 per cent, mortgage bonds.

BONDHOLDERS COMMITTEE FOR DENVER INTERESTS.—Emerson McMillin, who recently resigned from the chairmanship of the board of directors of the Denver Gas & Electric Comapny, has formed a bondholders protective committee to look after the interests of the holders of the $900,000 bonds of the Lacombe Electric Company which has been absorbed by the Denver company. The principal and interest of these bonds have been guaranteed by the Denver company with a provision for their exchange for the bonds of the larger concern. It is said that some of the bondholders are dissatisfied with the ratio of this proposed exchange and that is the reason for the formation of the committee. It is understood that Mr. McMillin is entirely out of the Denver company, but it is denied that there has been any rupture between him and the Doherty interests. The new financial plans of the Denver Gas & Electric Company have not been officially announced as yet, but they were fully outlined in the issue of last week.

RUMOR OF WESTERN UNION ABSORPTION REVIVED.—Wall Street was again saturated this week with rumors to the effect that the Western Union Telegraph Company was about to be absorbed by the American Telephone & Telegraph Company. This rumor was probably responsible for the increased activity of the stock on June 7, there being 3598 shares traded in, and a net gain for the day of two points. At the high point the stock reached 77½, which is the high record since 1907. President Robert C. Clowry of the Western Union said that he knew nothing of any deal to absorb his company and bankers who have been identified with American Telephone & Telegraph also denied knowledge of any such deal.

BOSTON, LOWELL & LAWRENCE ELECTRIC RAILROAD.—A certificate of public exigency has been applied for in Massachusetts by the Boston, Lowell & Lawrence Electric Railroad. The company has been organized with a capital stock of $400,000, and proposes to construct a line 25 miles long, with its southern terminus at Sullivan Square, Charlestion, and its northern terminus at Lowell, Mass. A branch line is proposed with the southern terminus at Tewksbury, and the northern terminus at Lawrence. It is said that all of the money is ready to construct this new line just as soon as the legal formalities have been complied with.

ELECTRICAL VEHICLE COMPANY'S AFFAIRS.—The Electrical Vehicle Company, of Hartford, Conn., has obtained an order from the United States Court to show cause why an offer of a reorganization committee to take over the entire assets, except the cash on hand, should not be accepted. Under this offer the general creditors will get about 20 per cent of the $800,000 they claim and the holders of the $2,500,000 bonds will waive their mortgage rights and also accept the 20 per cent offer. The company went into the hands of a receiver in December, 1907, but has been allowed to continue business ever since.

CHICAGO RAILWAY REHABILITATION.—Reports that have just been issued by the Chicago Railways and Chicago City Railway companies, under date of April 30, show that these interests have expended in the rehabilitation of their lines $27,654,806, in compliance with the terms of the new ordinance. Since February, 1908, the Chicago Railways Company has expended $11,565,205, and in the same time the Chicago City Railway Company has expended $15,753,901. These expenditures do not include the expenditures for the Calumet division, which were $335,700.

AMERICAN TELEPHONE STOCK LISTED IN PHILADELPHIA.—Application has been made to the Philadelphia Stock Exchange to list $232,587,600 capital stock of the American Telephone & Telegraph Company. This is the largest application ever made in the history of the Philadelphia Exchange. The stock is already listed in both New York and Boston.

GRAYLING ELECTRIC COMPANY.—The Grayling (Mich.) Electric Company reports that it has had a good year's business, and that it will be easily enabled to pay a dividend of 10 per cent on its stock from this year's operations. It does not at this time contemplate any extensive improvements or additions.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Cities Railway & Light Company, New York:					
Year 1908	$547,897	$29,501	$518,396	$414,366	$104,030
Year 1907	527,122	17,348	509,774	414,370	95,404
Associated Bell Operating Companies:					
April, 1909	11,093,600	7,972,500	3,121,100	603,700	2,517,400
April, 1908	10,282,000	7,293,500	2,988,500	641,800	2,346,700
Auburn (N. Y.) & Syracuse Electric Railroad Company:					
Quarter ended March 31, 1909	81,948	59,993	21,955	25,625	*3,669
Quarter ended March 31, 1908	70,741	50,847	19,894	23,021	3,127
Metropolitan Street Railway, New York:					
Quarter ended March 31, 1909	2,927,503	2,036,103	891,400	.....	.....
Quarter ended March 31, 1908	3,360,345	2,913,320	447,025	.....	.....
Twin City Rapid Transit Company, Minneapolis:					
April, 1909	537,049	261,714	275,325	140,367	134,968
April, 1908	493,497	246,325	247,172	126,075	121,097
United Traction Company (Albany-Troy, N. Y.):					
Quarter ended March 31, 1909	454,260	295,210	159,049	83,521	86,800
Quarter ended March 31, 1908	453,702	323,799	129,903	74,999	70 262

*Deficit.

GENERAL NEWS

Construction News.

COPPER CREEK, ARIZ.—Preparations are being made by the Copper Queen Mining Company to double the output of its electric power plant at its mines. An additional 300-hp engine will be installed.

JEROME, ARIZ.—The Council has granted a 25-year franchise to the Arizona Telephone Company for the erection of a telephone system. It is said that the company will commence work at once on the construction of its system.

TUCSON, ARIZ.—John Metz, of Tucson, is interested in a company which has purchased the controlling interest in the water works system of Benson and has also purchased the Benson gas works. The company is planning to install an electric lighting plant in the near future.

MORRILLTON, ARK.—The Russellville Water & Light Company is contemplating furnishing electricity in Morrillton for lamps and motors. A. Brewster is president.

SEARCY, ARK.—Plans are being considered by the Searchlight Power & Electric Company for the construction of a power plant and street railway system. The cost of the plant is estimated at from $250,000 to $300,000. The street railway will extend from Gallaway College to Searcy, through the city and suburbs. As yet no engineer has been secured. Louis Lorch is president.

ALAMEDA, CAL.—Plans are being made by the Pacific Telephone & Telegraph Company for extensive improvements and extensions to its system in Alameda, which will involve an expenditure of nearly $200,000. The work will include the installation of new instruments and switchboards and placing its overhead wires in cables and the removal of the wires from Park Street.

AUBURN, CAL.—It is reported that William Mayer contemplates the installation of an electric plant to furnish electricity for domestic and other purposes.

DOWNEY, CAL.—Plans are being made by the Downey Light, Power & Water Company to extend its transmission lines to Rivera. J. R. Gordon is proprietor of the plant.

DOWNIEVILLE, CAL.—Walter Painter and Homer Gould have appropriated 15,000 cu. in. of water of the North Yuba River, just below Downieville, which will be utilized to generate electricity for mining and lighting purposes.

GLENDALE, CAL.—The City Council has passed an ordinance calling for a special election to be held June 22 to vote on the proposition of issuing $60,000 in bonds, the proceeds to be used for the purpose of establishing a municipal electric light plant.

LOS ANGELES, CAL.—M. J. Nolan has been granted a franchise by the Board of Supervisors to construct and operate an electric street railway on the extension of Washington Street.

OAKLAND, CAL.—The Central Oakland Light & Power Company has petitioned for authority to increase its bonded indebtedness by $800,000. The company is planning to enlarge and extend its systems.

RED BLUFF, CAL.—W. F. Luning has filed notice of appropriation of 12,000 cu. in. of water in Mill Creek to be utilized to generate electricity.

SAN DIEGO, CAL.—L. J. Wilde, president of the American National Bank, is reported to have donated $10,000 to the Park Commission for the erection of an electric fountain in the city plaza.

SAN FRANCISCO, CAL.—The United Railroads of San Francisco expects to purchase motor-generator sets with a total rating of 20,000 kw for sub-stations.

SAN FRANCISCO, CAL.—The City Council has passed an ordinance calling for the removal of overhead wires which are to be placed under ground at the rate of 2½ miles a year.

SAN FRANCISCO, CAL.—The Great Western Power Company is reported to have closed a contract with the Southern Pacific Railroad Company to furnish electricity for operating all the suburban lines of the railroad company about the metropolis, such as the broad-gage and its Alameda lines. H. H. Sinclair, vice-president of the Edison Electric Company, has been appointed manager of the Great Western Company. Mr. Sinclair states that $2,000,000 will be expended by the power company within the next two years in addition to the $8,000,000 already invested. A dam which will cost $8,000,000 is to be erected on the Feather River, work on which will be started next fall.

UKIAH, CAL.—Plans are being considered by the Snow Mountain Power Company to enlarge its generating plant on Eel River. Another dam is to be erected and another 5000-kw dynamo installed in the power house.

DENVER, COL.—It is reported that the Colorado & Southern Railway Company is reported to have entered into a contract with the Colorado Central Power Company to furnish electricity to operate its famous Georgetown Loop. This is the initial road to be equipped for electrical operation. It is said that arrangements will be made to convert other lines of the Colorado & Southern Railway Company to be operated by electrical power.

DENVER, COLO.—The stockholders of the Denver Gas & Electric Company have authorized the organization of a new company to be called the Denver Gas & Electric Light Company, which will consolidate the various properties and subsidiary companies owned by the present company, and to issue $25,000,000 general mortgage 5 per cent bonds. The action is taken owing to the necessity of providing for the capital requirements of the company's rapidly growing business and with a view to an ultimate extension of operations. Of the $25,000,000 in bonds, $7,000,000 will be set aside to retire the present outstanding bonds of the company, and the remainder will be used as required for the needs of the company.

DURANGO, COL.—The property of the Animas Power & Water Company, which was purchased recently by W. N. Vaile, of Denver, Col., for $750,000, for the bondholders, has been transferred to the San Juan Water & Power Company, which has been incorporated, with a capital stock of $1,000,000. S. Z. Mitchell, of New York, N. Y., is interested in the new company.

BRISTOL, CONN.—The C. J. Root Company, manufacturer of wrought brass hinges and counting machines, it is reported, will erect a new factory building together with a power house. The company expects to purchase a boiler and engine, which later may possibly be direct connected with generator.

DANIELSON, CONN.—The Cochrane Power Company has applied to the Legislature for a charter. The new company is a subsidiary of the Danielsonville Cotton Company and has been formed for the purpose of constructing a transmission line to the mills of the Danielsonville company from the plant of the Cochrane Power Company located on the Quinebaug River, a distance of about five miles. It is to be capitalized at $100,000 and is authorized to issue bonds to the amount of 75 per cent of its outstanding capitalization.

HARTFORD, CONN.—The Universal Machine Screw Company has purchased a site at the north end of the city, on which it will erect a new plant in the near future. The plant will be electrically driven, the energy being secured from the local electric company.

NEW HAVEN, CONN.—The State Board of Railroad Commissioners has approved the plans of the proposed electric railway to be constructed by the Shore Line Electric Railway Company from Saybrook to Madison, passing through the towns of Westbrook and Clinton.

NORWICH, CONN.—The Gas and Electric Commissioners have voted to reduce the price of electricity for power purposes. Under the new schedule beginning Aug. 1, the rates are to be as follows: From 1 to 500 kw used in one month, five cents per kw-hour, and all over 500 kw used in one month at two cents per kw-hour. The minimum charge on motors will be $2 per month for one-horse power motor or less and 50 cents per month for each additional horse power while connected with the city lines. Under the existing schedule the prices range from 2½ cents to nine cents per kw-hour.

WILLIMANTIC, CONN.—The plant and holdings of the Willimantic Gas & Electric Company have been purchased by a syndicate in which A. M. Young, of Waterbury, Conn., is interested. Arrangements have been made to secure electricity from the hydro-electric plant of the Uncas Electric Company at Scotland Station. The change will require some alterations in the plant and station and the installation of new machinery. The distributing systems of both the gas and electric plants will be thoroughly overhauled and repaired, work on which will begin in the near future. F. C. Slade has been appointed local manager.

WASHINGTON, D. C.—The Bluemont division of the Southern Railway Company, recently acquired by Stephen B. Elkins and John B. McLean, of Washington, is to be equipped to be operated by electricity and extended to Winchester. At present the road extends from Washington to Bluemont.

WASHINGTON, D. C.—President Taft on May 29 sent two short messages to Congress transmitting ordinances recently approved by the executive council of the island of Porto Rico. One granted an extension of time to the Ponce Railway & Light Company in which to complete certain extensions, and the other granted the San Juan Light & Transit Company permission to operate an electric railway between San Juan and Rio Piedras, and to supply electricity for lamps to the public.

DEFUNIAK, FLA.—At an election held recently the citizens defeated the proposition to issue $10,000 for the construction of an electric light plant.

FORT MEADE, FLA.—The contract for installing an electric light plant at this post was awarded to the Electrical Construction Company, of Tampa, Fla., to cost $10,000. Engines and other equipment will be furnished by Fairbanks-Morse Company, of Chicago, Ill.

TIGER BAY, FLA.—The Palmetto Phosphate Company is reported to have placed a contract with the Allis-Chalmers Company, of Milwaukee, Wis., for three gas engines with a total rating of 1000 hp to be direct connected to three electric generators.

ATLANTA, GA.—Plans are being prepared by the Piedmont Power Company for the erection of transmission lines for the distribution of electricity in this city, for which the City Council has granted the company a 50-year franchise. Louis B. Magid is president of the company.

ATLANTA, GA.—The National Manufacturing Company, recently incorporated, has purchased the plant of the Georgia Plow Works in this city, which will be utilized for the manufacture of cotton ties. The company is said to be in the market for three 5-hp, 220-volt, low speed, 3-phase, alternating-current motors. R. M. Freeman is president of the company.

COVINGTON, GA.—The City Council has granted a 5-year franchise to the Oxford & Covington Street Railway Company to construct and operate an electric railway in Covington.

SALMON, IDAHO.—G. B. Quarles, secretary of the Salmon Electric Company, writes that the plant and holdings of the Salmon Electric Company have been purchased by the Andrews Light & Power Company.

ELGIN, ILL.—It is said that arrangements have been made with the Aurora, Elgin & Chicago Railway Company, whereby the old street arc lamps now in use will be replaced with new and modern lamps.

FREEPORT, ILL.—W. T. Raleigh is reported to be interested in a project to construct an electric railway from Freeport, Ill., to Madison, Wis., via Cedarville, Rock Grove, Oakley and Brodhead.

HENNING, ILL.—The village has entered into a contract with R. C. Wilson & Company for electric light service in Henning. It is expected to have the system installed within 90 days.

MATTOON, ILL.—The Decatur, Sullivan & Mattoon Transit Company has filed a deed making the Windsor Trust Company, of New York, N. Y., trustee in an authorized bond issue of $2,500,000. The company proposes to construct an electric railway from Decatur to Mattoon, Ill., a distance of 48 miles.

HUNTINGTON, IND.—The contract for installing new boilers in the municipal electric light plant has been awarded to the Bass Foundry & Machine Company, of Fort Wayne, Ind.; the Fort Wayne Electric Company will furnish the generators.

INDIANAPOLIS, IND.—The capital stock of the Citizens' Telephone Company has been increased from $50,000 to $100,000.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company is making a display and demonstrating various electrical devices for household uses, at its office, ranging from an electric shaving mug to an electric grate. C. E. Pruyn, of the General Electric Company, has charge of the demonstration.

ROANOKE, IND.—The Fort Wayne & Wabash Valley Traction Company has been granted a franchise by the Town Council to furnish electricity for lamps and motors in the town. Under the terms of the franchise the maximum charge for electricity is to be 10 cents per kw-hour. The franchise does not include street lighting service.

BRITT, IA.—The Hancock County Telephone Company is planning to purchase the Western Electric Company's telephone line and extending it to Crystal Lake.

DES MOINES, IA.—Arrangements are being made by the Mutual Telephone Company for making improvements to its system, which will involve an expenditure of about $85,000.

FAIRFIELD, IA.—The Fairfield Gas & Electric Company contemplates rebuilding its plant, which will involve an expenditure of about $20,000. The company has recently completed a gas tank with a capacity of 30,000 cu. ft.

GRINNELL, IA.—Arrangements are being made by the Interior Telephone Company for extensive improvements to its system, which will involve an expenditure of from $20,000 to $30,000.

KEOKUK, IA.—H. L. Cooper has been in this city recently making investigations with a view of building a dam on the Mississippi River and constructing a power plant with an output of 200,000 hp. John R. Freeman, consulting engineer, of Providence, R. I., is assisting Mr. Cooper in his examinations.

LAWTON, IA.—The capital stock of the Lawton Telephone Company has been increased from $2,000 to $9,000.

DELPHOS, KAN.—The City of Delphos is reported to have sold an issue of bonds amounting to $30,000, the proceeds to be used for the construction of a municipal electric light plant. It is said that bids will be asked in about 30 days for machinery and equipment for the plant.

PLAINVILLE, KAN.—Bids will be received by the City of Plainville for the construction of a water works system. An electric motor or gasoline motor will be purchased for operating the pump.

WICHITA, KAN.—A company is being organized to construct an interurban railway from Wichita to Hutchinson and thence to Newton by the way of Burton and from Newton via Valley Center and Sedgwick. Capital stock to the amount of $100,000 has already been subscribed by Wichita business men.

LOUISVILLE, KY.—The George G. Fetter Power & Lighting Company has secured a site on Bullitt Street for its proposed power station. Work will soon commence on construction of the plant, which when completed will cost about $200,000. In addition to furnishing electricity for lamps and motors, the company proposes to manufacture ice on a large scale.

BELGRADE LAKES, MAINE.—The power plant of the Union Gas & Electric Company, of Waterville, was destroyed by fire May 31, causing a loss of about $10,000. The plant furnished electricity for operating the novelty mill and for lighting the Belgrade House and surrounding places. Temporary arrangements have been made to furnish electricity for lighting the hotel.

BUCKSPORT, MAINE.—Arrangements are being made by the Penobscot Bay Electric Company to extend its transmission line to the town of Searsport and the city of Belfast. The company will commence work on the extension as soon as possible after the special act of the last Legislature giving the company the right to enter these two municipalities becomes effective, which is July 1. The company has a plant at the Toddy Pond at East Orland, and has extended its transmission lines across the Penobscot River at Bucksport through Prospect to Stockton Springs and furnishes electrical service all along its lines.

BOSTON, MASS.—The Old Colony Street Railway Company is preparing plans to increase the efficiency of its service by providing for a secondary high-tension circuit the entire distance from the main power house in Quincy to Fall River. The secondary system will be erected over the same route and the same poles used as for the primary service, passing through Bridgewater to Taunton and Fall River. The same transforming stations will be used.

HOLDEN, MASS.—At a special election held May 27 the proposition to establish a municipal electric light plant was defeated.

MANSFIELD, MASS.—The municipal electric light and power plant, which was installed five years ago, has proven a success and now furnishes electricity for lighting 26 miles of streets at a cost of about $5,000 per year.

NORTH ADAMS, MASS.—Preliminary plans have been prepared by the Massachusetts Lighting Company, which owns and controls the North Adams, Adams, Williamstown (Mass.) and Stamford (Vt.) companies for the construction of a steel power house which will be erected on the site of the present plant. It is said that turbine engines will be installed.

SHREWSBURY, MASS.—The lighting committee has awarded the contract for extending the municipal street lighting system to the Delta Electric Company, of Worcester, Mass., for $7,040. The work will include the erection of eight and one-quarter miles of wire and 107 lamps. F. H. Smith, of Worcester, will have charge of the construction work.

UPTON, MASS.—At a special town meeting held May 28 the citizens voted to accept the report of the special committee recommending the town to enter into a contract with the Upton Electric Light Company for lighting the streets of the village for a period of three years. Under the terms of the contract the company is to furnish 91 street lamps at $16.50 each per year.

WESTFIELD, MASS.—Specifications have been prepared for enlarging the municipal electric light plant. It is stated that bids will soon be called for the installation of an engine rated at 500 or 600 hp.

ANOKA, MINN.—It is reported that the Anoka Electric & Water Works Company has accepted the tentative offer of the city to purchase the plants and holdings of the company for $40,000.

JORDAN, MINN.—Plans are being made by the Jordan Electric Light & Heating Company to increase the capacity of its storage battery.

MAZEPPA, MINN.—The Goodhue County Telephone Company has been granted a franchise to construct and maintain a telephone system in Mazeppa.

STILLWATER, MINN.—It is reported that plans are being considered to organize a company to take over the Stillwater electric light plant and the power plants at Apple River, Wis.

PRENTISS, MISS.—A company is being organized to install a telephone system in Prentiss. E. L. Gressitt, of Meridian, Miss., is interested in the enterprise.

MOBERLY, MO.—The City Council has granted the franchise for construction of an electric railway from Moberly to Huntville, for which most of the right of way has been secured. Manning, Wellman & Company are promters of the project.

ST. LOUIS, MO.—The Downtown Lighting Association has adopted the report of the Executive Board and will solicit subscriptions toward the $30,000 fund for the purchase of the lamp standards for the new lighting system, which the Union Electric Light & Power Company has agreed to manufacture and deliver for $50 each in connection with the new luminous arc lamp the company proposes to install. As the company is now furnishing direct-current lamps, the change in the service will cost about $100,000. Under the new contract 322 new lamps are to be installed at a cost of $50 per lamp per year, and with the lamps now in use will make a total of 470 to be supplied at the rate of $98 each per year until September, 1910, when the new contract will take effect.

UNIVERSITY (P. O., ST. LOUIS) MO.—Plans are being prepared by B. H. Colby, Security Building, St. Louis, Mo., for an electric light plant for University, to cost $100,000. E. G. Lewis is Mayor.

ABSAROKEE, MONT.—We are informed that G. M. Hawkins, of Absarokee, is interested in a project to construct an electric railway 12 miles long, in the vicinity of Absarokee.

KALISPELL, MONT.—The Northern Idaho & Montana Power Company, which recently took over the electric light and power plants and sites at Sandpoint and on Moyie River, formerly controlled by J. L. Drumheller, of Spokane, Wash., has purchased the plant and holdings,

including the local telephone and water service, from the Kalispell Water & Electric Company, on which it has held an option for 60 days. The company recently purchased the Big Fork power plant of the Flathead Valley Water Power Company. Extensive improvements are contemplated to the local systems, which will involve an expenditure of about $200,000, and about $100,000 will be expended on the Big Fork plant, which will include the construction of a concrete flume to carry water from the Big Fork River to the power house. The telephone lines will be entirely rebuilt and a long-distance line built to connect with the Bell system to the south. It is said that work will commence at once on improvements. O. A. Farrar is manager.

MILES CITY, MONT.—It is reported that James A. Murray, owner of the Hunter's Hot Springs resort, contemplates the construction of an electric railway to connect the hotel with the Northern Pacific Railway. The railway will be 2½ miles long. Electricity for operating the railway will be furnished by the Madison River Power Company or from a plant which it is proposed to install at Hunter's.

CENTRAL CITY, NEB.—A petition has been circulated asking for a special election to be held to vote on the proposition to issue bonds for construction of a municipal electric light plant. The cost of such a plant is estimated at $20,000, and if established, would also furnish electricity for the municipal water-works system.

AUSTIN, NEV.—Plans are being considered by the Austin Manhattan Consolidated Mining Company for the construction of a power plant on Big Creek, for which surveys have been completed. It is estimated that 500 hp can be developed.

GOLDFIELD, NEV.—Plans are being considered by the Codd Mines Company for the installation of a power plant and mill on the East Walker River.

TILTON, N. H.—The Tilton Electric Company has purchased the interests of the Tilton Mills in the lower dam and will commence work at once on the development of the water power. John Dresser, engineer, of Franklin, N. H., will have charge of the construction work.

CAMDEN, N. J.—It is reported that the Armstrong Cork Company has awarded a contract to the Allis-Chalmers Company, of Milwaukee, Wis., for a 1500-kw, gas-driven electric unit and seven standard 30,000 cu. ft., gas-driven blowing engines for various blast furnace plants.

JERSEY CITY, N. J.—Bids will be received until June 22 by the new county building committee at its office, 573 Newark Avenue, Jersey City, N. J., for furnishing and installing electric lighting fixtures in the new county court house. Frederick Rippe is president of the committee.

MORRISTOWN, N. J.—The Morris County Traction Company will soon let contracts for additional equipment for its power plant.

PORTALES, N. M.—At a recent election the citizens voted to issue $75,000 in bonds for municipal ownership of water works, electric plant and sewerage system.

ALBANY, N. Y.—Application has been made by the New York State Railways to the Public Service Commission, Second District, for permission to increase its capital stock from $23,140,200 to $23,860,200, and for authority to purchase the stocks of various street railroad corporations and to execute a first consolidated and refunding mortgage to secure $35,000,000 in bonds and to issue at present $6,500,000 under this mortgage. With the $720,000 increase in capital stock, $674,000 will be utilized to purchase from the New York Central and the Central syndicate their holdings of stock of the Rochester & Suburban Railway Company, the Rochester Electric Railway Company and the Ontario Light & Traction Company, giving an equal amount of new stock at par in exchange, and to acquire from time to time the remaining outstanding stock of the Rochester & Suburban Railway and the Rochester Electric Railway Company, amounting to $45,300. The $6,500,000 in bonds to be issued are to refund outstanding bonds and notes of the companies owned and controlled by the company. In addition provision is made for $1,693,366 in bonds, to provide funds for the acquisition of property, construction and extension.

BUFFALO, N. Y.—The contracts for furnishing and installing electric lighting fixtures in the city hall in connection with the new electric light plant for the building, was awarded to Wahle-Phillips, of New York, N. Y., for $27,000.

BUFFALO, N. Y.—Bids have been opened for the construction of conduits for the police and fire departments to connect with existing conduits, which call for 6400 ft. of creosoted wood conduit and 800 ft. of tile duct to be laid. Proposals will soon be asked for cables to be laid in the conduits, which will cost from $15,000 to $20,000.

COEYMANS, N. Y.—The Public Service Commission, Second District, has refused the application of the Upper Hudson Electric Light & Power Company, of Newburgh, N. Y., for the institution of legal proceedings to enjoin the Atlantic Light & Power Company from doing business in Coeymans and New Baltimore, the Hudson company alleging unlawful exercise of franchises in the town of Cocymans by the Atlantic company. According to the decision handed down by the Public Service Commission, the Atlantic Light & Fower Company is exercising its franchises in both places in good faith.

GOUVERNEUR, N. Y.—Plans are being prepared for the construction of a large power plant at South Edwards on the east branch of the Oswegatchie River, 15 miles from Gouverneur, contracts for the construction of which, it is said, will be awarded within a short time. The plans call for the construction of a concrete dam and a large power house. The plant will furnish electricity for the Diana Paper Company's mill at Harrisville, which will require about 1500 hp. A high-tension transmission line will be erected to Carthage and surrounding towns. It is said that eventually the plant will furnish electricity to operate the Carthage and Watertown electric railway.

MEDINA, N. Y.—The A. L. Swett Electric Light & Power Company has been granted permission by the Public Service Commission to extend its transmission lines to Yates to furnish electricity in that town.

MUMFORD, N. Y.—The town, which has been without electric service since the closing down of the Hyde plant some years ago, is again lighted by electricity furnished by the L. H. Gardiner Paper Company. The company recently installed a dynamo in its plant and is now furnishing electricity for several business places and residences in the town.

NEWFANE, N. Y.—The Bell Telephone Company has purchased the plant and holdings of the Lakeside Telephone Company, including its lines in the towns of Newfane, Lyndonville, Waterport and Morton, and will soon take possession of the system.

NEW YORK, N. Y.—The Board of Estimate and Apportionment has appropriated $100,000 for preparation of plans for a new fire alarm system, and $750,000 was appropriated for extension of high-pressure service in South Brooklyn.

NEW YORK, N. Y.—The Board of Estimate has approved the application of the Hudson & Manhattan Railway Company for permission to extend its tunnels to the Grand Central Station. The extension has already been favorably passed upon by the Public Service Commission and as soon as the Mayor signs the franchise steps will be taken immediately to begin work on the new tunnel. It is expected to have the extension ready in 1911. William G. McAdoo is president.

NEW YORK, N. Y.—Plans are nearly completed for reorganizing the Third Avenue Railroad Company, although the properties are not to be sold until next fall. Under the plan of reorganization the stockholders will be asked to authorize an expenditure of $7,500,000, of which $1,000,000 will be spent for new tracks; $2,500,000 will be required to take up the receiver's certificate, which was given by Frederick W. Whitridge, receiver, when appointed by Judge Lacombe. The remaining $4,000,000 will be used for new cars, extensions and improving the power service.

NIAGARA FALLS, N. Y.—It is reported that the United States Light & Heating Company contemplates locating its plant in Niagara Falls. The company is capitalized at $17,500,000 and proposes to manufacture car lighting equipment, including a system in which the power is obtained from the car axle. The company also owns a patent roller-bearing power transmission system. W. H. Silverthorn is president and J. A. Smith, general manager.

ONEIDA, N. Y.—Application has been made to the Public Service Commission, Second District, by the Oneida Railway Company, for permission to construct an extension from Sherrill to Kenwood.

ROCHESTER, N. Y.—The Rochester Railway & Light Company is contemplating the installation of a 1,500-kw transformer in its substation at Mill and Commercial streets.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has made a reduction of 10 per cent in the price of electricity. In view of the reduced rates, the company is issuing a new form of contract, known as the "Constant Demand Contract." Under this contract the company will sell to large consumers electricity at less than $30 per horse-power per year on the outskirts of the city. To consumers in the center of the city the rate for the same service will be $41 per horse-power per year. The higher cost of the service in the city is due to the more expensive transforming and distributing apparatus required. C. J. Parker is consulting engineer.

SYRACUSE, N. Y.—It is reported that the George V. Fowler Realty Company is preparing plans for the construction of a 10-story apartment building in this city. It is proposed to install a high pressure power plant, an electric generating plant to furnish electricity for lamps and elevators; also refrigerating and vacuum cleaning plants. The company has an office at 220 Broadway, New York.

THERESA, N. Y.—George P. Schwarz, secretary of the Hydro-Electric Power Company, writes that the company is contemplating the installation of a pair of twin water wheels and generator in the near future.

KERNERSVILLE, N. C.—The Kernersville Light & Power Company, recently organized to establish an electric light plant, has been granted a 25-year franchise. C. C. Sapp is president; R. R. Clinard, vice-president; Charles S. Swann, secretary and manager, and D. W. Harmon, treasurer of the company.

BLACKWATER, N. D.—Plans are being considered for the organization of a company to erect a telephone system to connect with the central exchange at Garrison. Mr. Mathany is interested in the enterprise.

GRAND FORKS, N. D.—The Grand Forks Street Railway Company is considering the purchase of second-hand equipment for its power plant as follows: One 100-kw belted railway generator, 550-600 volts; one 250-kw 550-volt generator, direct connected to a compound condensing engine; boilers, heaters, switchboard, etc., complete.

GRANVILLE, N. D.—The County Board has granted David Olster and others a franchise to construct a telephone system in this county.

LANSFORD, N. D.—The First Farmers' Telephone Association is said to be planning to erect 50 miles of new telephone line this season.

NEW SALEM, N. D.—Arrangements are being made to erect a telephone line to Rosebud, a distance of about 30 miles.

RYDER, N. D.—Arrangements are being made by the Queen City Telephone Company to erect a telephone line to Minot.

WASHBURN, N. D.—The contract for the erection of a telephone line to Turtle Lake, 25 miles in length, has been awarded to Roy Joslin.

AKRON, OHIO.—The Northern Ohio Traction & Light Company is said to be considering the question of constructing an electric railway between Akron and Massillon, over a right-of-way that was purchased and partly graded several years ago.

CINCINNATI, OHIO.—The Cincinnati, Lawrenceburg & Aurora Electric Street Railway Company, it is said, is preparing plans to extend its railway to Rising Sun, and also to Scottsburg, with a view of connecting with the Indianapolis & Louisville Traction Company, affording direct connection to Indianapolis and Louisville.

CLEVELAND, OHIO.—The Cleveland, Barberton, Coshocton & Zanesville Railway Company is considering plans for the construction of its proposed electric railway entering Zanesville, and securing the right of way in the city. The company will soon apply to the City Council for a franchise. It is said that work on construction of the road will be started at Coshocton by the middle of this month. A power plant will be erected at Otsego.

COLUMBUS, OHIO.—The contract for the construction of an addition to the power house at the Ohio State University has been awarded to George Abernethy, of Columbus, Ohio, for $3,888. Plans were prepared by Herbert Edwards.

COLUMBUS, OHIO.—The City Council has granted the Ohio Electric Railway Company a 25-year blanket franchise over the streets of the city to secure a new $175,000 union interurban station at South Third and Rich Streets and also to establish a new electric light rate of 7 cents per kw-hour for a term of five years.

RICHWOOD, OHIO.—Bids will be received until June 19 by Ray L. Jordan for lighting the streets with not less than 35 arc lamps of not less than 200 cp for a term of ten years. Specifications are on file at the office of the village clerk.

SPENCERVILLE, OHIO.—The Jennings Telephone Company has secured a franchise to extend its telephone system to Spencerville.

BLACKWELL, OKLA.—The citizens on May 25 voted to issue $25,000 in bonds for extensions to the electric light plant and $30,000 for extending the water-works system. Burns & McDonnell, of Kansas City, Mo., are consulting engineers.

CHICKASHA, OKLA.—Plans are being considered by S. J. Lee, of the electric planing mill, to enlarge the plant.

EL RENO, OKLA.—The El Reno Gas & Electric Company is rebuilding its entire electric lighting system, erecting new poles, wires, etc.

OKMULGEE, OKLA.—The citizens have voted to grant the Okmulgee Interurban Railway Company a franchise to construct an electric railway in Okmulgee. J. B. Jones, of Muskogee, is interested in the company.

OKMULGEE, OKLA.—The Pioneer Telephone Company is contemplating making improvements and extensions to its system, involving an expenditure of about $28,000.

TEXHOMA, OKLA.—John F. Allison, town clerk, writes that the town would like to grant a franchise to some one who would install an electric light system, ice plant and water works, for which he states there is a good opening.

WAPANUCKE, OKLA.—The city is contemplating the installation of an electric light plant and water works system. The proposition to issue $50,000 in bonds for construction of same will be submitted to the vote of the people.

EUGENE, ORE.—The McKenzie Valley Irrigation & Power Company has been granted a franchise to furnish electricity for lamps and motors in Springfield and this city.

PORTLAND, ORE.—Application has been made to the City Council by Dr. Henry Waldo Coe, president of the St. Helena Public Service Company, for a franchise to enter the City of Portland by the way of Tenth Street East and West.

PANAMA.—Proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until July 19, for furnishing machinery for a central pumping station and three pumping units for hydraulic excavating and sluicing, including pumps and motors, engines, boilers, monitors, pipe and fittings, etc. Blanks and general information relating to this circular (No. 516) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 316 Hibernia Bank Building, New Orleans, La., and North Point Street, San Francisco, Cal. Capt. F. C. Boggs is general purchasing officer.

BUTLER, PA.—The residents of North Butler are considering the question of lighting the streets in that section of the town.

CARLISLE, PA.—Bids will be received by W. Friedman, superintendent U. S. Indian School, Carlisle, Pa., for furnishing and delivering as required 1,200 electric lamps during the fiscal year ending June 30, 1910.

ELLWOOD, PA.—It is reported that arrangements have been completed by the Pennsylvania Power Company for equipping its power station with a turbo-generator.

JOHNSTOWN, PA.—Notice has been given by Wallace Sherbine, Thomas J. Pearce, Alvin Sherbine and H. W. Storey that they will apply to the Governor of Pennsylvania for a charter for the Johnstown & Gallitzin Railway Company, which proposes to construct and operate a street railway from Johnstown to Gallitzin.

MIDDLEBURG, PA.—The Borough Council has granted the Middleburg Light, Heat & Power Company a franchise to construct and maintain an electric transmission system for the distribution of electricity for lamps and motors in Middleburg.

PHILADELPHIA, PA.—It is reported that the Philadelphia Electric Company has entered into a contract to furnish electricity to the Delaware County Electric Company, recently organized, which supplies electrical service to a large part of the towns in Delaware County. Under the agreement the Philadelphia Electric Company will furnish electrical energy for the territory between Philadelphia and Media, including the towns of Swathmore, Morton and Wallingford, which will be distributed by the Delaware County Electric Company.

PLYMOUTH, PA.—The Commissioners are considering the question of lighting the streets of the town by electricity.

READING, PA.—The 1000-hp engine recently installed in the Metropolitan Electric Company's plant on South Seventh Street has been placed in service. This addition will enable the company to supply all the electricity needed in the city until the new plant on the west side of the Schuylkill is ready. It is expected to have one 5000-kw generator in the new power station in service by Nov. 1. When the new plant is placed in operation a new system will be adopted which will include 14 rotary converter stations in different parts of the city and country, four of which will be located in Reading, two at the new plant to supply electricity for the Mohnsville railway and the Womelsdorf lines. Others will be placed at Robesonia, Mohnton, two in the vicinity of the Mt. Penn, Oley line, Shanesville, Ringing Rocks and other points. In addition to the rotary stations, there will be one portable station, which will be built on a car to be used in cases of emergency. The equipment of the present plant will be removed to the new power station when completed.

YORK, PA.—The York Railways Company is said to be contemplating extensions and improvements to its system in this city, involving an expenditure of $100,000, provided it can obtain certain concessions from the city.

ALTON, R. I.—Plans are being made to light the village by electricity, which will be furnished from the plant in the mill of the Richmond Lace Company. Eight arc lamps will be erected for lighting the streets, and 22 tenement houses belonging to the Richmond Lace Company will be wired for electric lamps. Several of the residences, the church and store will have electric lamps installed. The Whitall Electric Company, of Westerly, R. I., has been awarded the contract for the work.

PROVIDENCE, R. I.—Arrangements are being made by the Narragansett Electric Lighting Company to install another 3500-kw Westinghouse-Parsons steam turbine in its power plant. The turbine will replace Corliss engines now in use in the power station.

SPARTANBURG, S. C.—The Southern Power Company, of Charlotte, S. C., has been granted a franchise to furnish electricity in Spartanburg for lamps and motors.

ABERDEEN, S. D.—The Dakota Central Telephone Company is planning to extend its system through the new county west of the Missouri River. The lines will be extended to new towns along the Milwaukee extension and to the new reservation towns as soon as they are platted. The cost of the proposed work is estimated at $30,000.

CARTHAGE, S. D.—H. R. Potter has made application for a 20-year franchise to install an electric light system.

HURON, S. D.—The local electric light plant, owned by C. I. Bowe, has been purchased by Coler Campbell, secretary of the Huron Light & Power Company, who has been granted a 20-year franchise by the city. Through the change of ownership the control of the electric plant passes to the gas company.

LAKE PRESTON, S. D.—A franchise has been granted to the Lake Preston Milling Company to install and operate an electric light plant.

PIERRE, S. D.—Bids will be received by the State Capitol Commission until June 29 for furnishing and installing electric fixtures in the new capitol. John Hirning is secretary of the commission and C. E. Bell, Northwestern Building, Minneapolis, Minn., is the architect.

WEBSTER, S. D.—Plans are being made by the Dakota Central Telephone Company to erect a circuit to connect with the Missouri River Telephone Company's lines, at a cost of $30,000.

CHATTANOOGA, TENN.—It is stated that the Chattanooga & Tennessee River Power Company will increase its capital stock from $3,000,000 to $5,000,000.

KNOXVILLE, TENN.—Charles Dawes, representing the Knoxville-Kingston Interurban Railway Company, has applied to the City Council for an electric railway franchise.

NASHVILLE, TENN.—The Nashville & Crocker Springs Rapid Transit Railway Company, it is said, will let contracts for the construction of its proposed electric railway as soon as the right of way is secured. The company is capitalized at $50,000 and proposes to construct an electric railway between Nashville and Crocker Springs, a distance of 10¾ miles. Lee Guggenheim is president and general manager.

CARO, TEX.—The Saner-Whiteman Lumber Company is planning to rebuild its power plant which was destroyed by fire. A. 40-kw, 250-volt, direct-current generator will be installed. John C. Saner is president of the company.

EDNA, TEX.—It is reported that an electric light and ice plant will soon be established in Edna.

GALVESTON, TEX.—Bids will be received until June 17 by V. E. Austin, commissioner of streets and public property, for the purchase in whole or in part of a complete city arc lamp lighting system, consisting of 200 series 9.6 amp, open arc lamps; 64 series 9.6 amp, enclosed arc lamps; two cylinder, Buckeye engines 15.5 in. cylinder, two foot stroke, 196 r.p.m., shafting, pulley wheels, belting, etc.; six electric constant current transformers of 60 lamp capacity each, with automatic current regulators. One Ball engine single cylinder direct connected to a 220-volt Western Electric generator; one switchboard, consisting of two Western Electric marble arc panels of three circuits each; one Western Electric marble arc panel for incandescent service, containing volt meter, ammeter, circuit breaker and switches.

GALVESTON, TEX.—Bids will be received by V. E. Austin, commissioner of streets and public property, until June 17 for furnishing one direct connected steam engine generator set with a rating of 150 kw, including condenser, condenser pump, switchboard and other accessories to be installed in the municipal electric power plant. Bids will also be received at the same time and place for 300 series direct-current arc lamps of the luminous magnetite or metallic flame type and accessories, including constant current transformers, mercury arc rectifiers, panels, etc., as may be necessary to operate and control the above lamps on six circuits of 50 lamps each, from 2300 volts, 60 cycles. Plans and specifications are on file at the office of John D. Kelly, city secretary, and W. D. Masterson, city superintendent of electricity.

GATESVILLE, TEX.—The Gatesville Electric Light Company has awarded the Minneapolis Steel & Machinery Company, of Minneapolis, Minn., a contract to install a 75-hp Muenzel gas engine and lignite producer for its plant.

GEORGETOWN, TEX.—Plans are being considered for improvements to the light and water plants of the Georgetown Water, Light & Power Company, which will involve an expenditure of about $20,000.

GRAND PRAIRIE, TEX.—It is said that an electric light and power plant will be installed in connection with the establishment of a town near Grand Prairie. George D. Allen, of St. Louis, Mo., is interested in the enterprise.

GREGORY, TEX.—The Coleman-Fulton Pasture Company, it is said, contemplates the installation of an electric light plant with sufficient output to supply 1000 lamps, and possibly a few small motors.

PALACIOS, TEX.—Plans are being made by A. C. Randolph to construct an electric light plant to be operated in connection with his ice plant. The initial cost of the plant will be about $10,000 and will have an output sufficient to supply 1500 16-cp lamps. Work will commence at once on construction of the transmission lines, which will be extended to the Baptist Young People's Union Encampment grounds so as to light the grounds for the coming encampment in July.

ROTAN, TEX.—It is stated that Mr. Harris, of Comanche, Tex., is contemplating installing an electric light plant in Rotan.

SAN ANTONIO, TEX.—The St. Anthony Hotel Company has purchased a site on which it will erect a new power house for the hotel. Equipment will be installed for generating electricity for lamps and for pumping water for the hotel.

TEXAS CITY, TEX.—The Texas City Company, which has awarded the contract for extensive port improvements in Texas City, including the construction of a system of seven warehouses which will be equipped with electric freight conveyors. An electric power plant will be installed to operate these conveyors. The cost of the entire work will be approximately $2,000,000.

WACO, TEX.—The Central Texas Development Company, which was organized to promote the building of an electric interurban railway between Waco and Temple, has under consideration the matter of extending the proposed line north to Hillsboro and south from Temple to San Antonio by way of Austin.

LOGAN, UTAH.—It is reported that Jesse Knight, of Provo, Utah, is planning to establish power plants in several canyons throughout the State to furnish electricity for lamps and motors in many of the towns that are now supplied by the Telluride Power Company, as well as to towns that are without electrical service at present. It is said that it is proposed to operate in the district from Logan on the north to Nephi on the south, a belt 200 miles long and 100 miles wide through the most thickly populated portion of the State.

PARK CITY, UTAH.—Jesse Knight, of Provo, Utah, is said to be installing a hydro-electric plant on Snake Creek, a few miles from Park City to furnish electricity for enterprises in this city in which he is interested. Another hydro-electric plant will be located on the Santaquin Canyon Company to supply electricity for a smelter in Tintic. Mr. Knight is also contemplating the installation of a power plant on the Weber River to furnish electrical power to the mining industries in Park City and vicinity.

LEESBURG, VA.—The Leesburg Telephone Company has taken over the property and holdings of the Old Dominion Telephone Company, of Wheatland, Va., and the Farmers' Telephone Company, of Waterford, Va. It is proposed to rebuild the entire plants, installing new switchboards, erecting new trunk lines between important points, and furnish metallic service equipment. The company has acquired the telephone line between Leesburg and Aldie, which is being rebuilt. The plant of the Herndon & Leesburg Telephone Company has also been acquired by the company. The entire system will be operated under one management after July 1.

BELLINGHAM, WASH.—The Washington Mining & Developing Company contemplates the construction of a power plant on Collins Creek, to cost $200,000. W. N. Bath is one of the directors.

NOOSACK, WASH.—The Washington Mining & Developing Company, of Noosack, Wash., is said to be preparing plans for the construction of a large hydraulic power plant.

NORTH YAKIMA, WASH.—We are informed that A. N. Mougins is interested in a project to erect a hydro-electric plant on the Yakima River, near North Yakima, where about 10,000 hp will be developed. The cost of the work is estimated at about $750,000.

OLYMPIA, WASH.—The State Board of Control has awarded contracts for four complete rock-crushing plants to the Austin Manufacturing Company, of Chicago, Ill., for $13,899. The Allis-Chalmers Company, of Milwaukee, Wis., has the contract for furnishing engines, boilers, electrical machinery and pumps, to cost $36,000.

SOUTH BEND, WASH.—The Willapa Harbor Telephone Company is contemplating the installation of a new switchboard and new instruments.

SPOKANE, WASH.—Announcement has been made that the Spokane & Inland Empire Railway Company is planning to construct a branch railway 20 miles long into the Cœur d'Alene Indian Reservation, which is to be opened in August. The proposed road would leave the main line near Ochlare, Wash., and run to Plummer, Idaho, on the Milwaukee's main line.

VANCOUVER, WASH.—Plans are under consideration by the Vancouver Traction Company for extending its railway from Vancouver east to Camas, a distance of about 12 miles.

WENATCHEE, WASH.—The City Council has granted the Entait Light & Power Company a franchise to enter the city to supply electricity for lamp and motors.

ASHLAND, WIS.—The Ashland Light, Power & Street Railway Company has purchased the plant and holdings of the White River Power Company, which includes water rights, dam and power house at White River, transmission lines and poles, substation at Ashland, franchises and other rights, for a consideration of $150,000. The company, it is said, will soon commence work on the construction of the Prentice Park line. The company will eventually extend the street railway to Odanah and Washburn and also extend the lines in the city.

EVANSVILLE, WIS.—The Baker Manufacturing Company is planning to erect an addition to its factory and will install an electric power and lighting system. The equipment to be purchased includes engine, generator, boilers, motors, etc.

KENOSHA, WIS.—The Kenosha Electric Railway Company has secured a site on which it will erect a new power house, at a cost of $75,000.

FORT D. A. RUSSELL, WYO.—The contract for remodeling the electric light system at Fort D. A. Russell has been awarded to the F. E. Newberry Electric Company, of St. Louis, Mo., for $34,644.

EDMONTON, ALTA., CAN.—The Provincial Government has entered into an agreement with the Automatic Telephone Company, of Chicago, Ill., to install automatic telephone systems in East Calgary and Lethbridge. It is understood similar equipment will be placed in other cities in the province during the summer.

EDMONTON, ALTA., CAN.—A French syndicate, represented here by Short, Cross & Biggar, attorneys, has applied to the City Council for franchises for the construction of radial railway lines from this city with a total mileage of 160. The franchises will, in all probability, be granted, the Council being strongly in favor of the proposition.

VANCOUVER, B. C., CAN.—The British Columbia Electric Railway Company has awarded the contract for the enlargement of its hydraulic tunnel connecting Lake Coquitlam and Buntzen, to Naylor Brothers, of Huddersfield, Eng. The capacity of the tunnel will be trebled and the improvement is being made in connection with the construction of the new dam at the mouth of Lake Coquitlam, for which the company recently received permission from the Provincial authorities of British Columbia.

VANCOUVER, B. C., CAN.—The London board of directors of the British Columbia Electric Railway Company has voted to appropriate $2,500,000 for extensions and improvements to its system in Vancouver during the next 12 months. R. H. Sperling, general manager of the company, states that over half of the amount appropriated would be used for the construction of new tram lines in Vancouver. A new 10,000-hp water wheel and generator will be installled at the generating plant on the North Arm of the inlet at a cost of $250,000. A new dam will be erected at the mouth of Lake Coquitlam, to cost $200,000. Improvements will be made to the New Westminster interurban line between Vancouver and Central Park, which will involve an expenditure of about $200,000. The company will also equip the railway recently built by the Canadian Pacific Railway Company from New Westminster to Eburne along the North Arm of the Fraser to be operated by electricity. Several other extensions are also contemplated by the company.

VICTORIA, B. C., CAN.—Owing to the delay of the City Council on acting on the recent proposition submitted by the British Columbia Electric Railway Company, the plans for the development of water power on Jordan River have been held up. The company is willing to continue to take power from Goldstream if the city buys out the Esquimalt Company's works. It is endeavoring to secure the endorsement of the Board of Trade in connection with its proposed plans.

WINNEPEG, MAN., CAN.—It is reported that the city has decided to ask for bids for electrical equipment in connection with the civic power development at Point du Bois, the cost of which is estimated at $500,000. Cecil B. Smith is engineer in charge of the work.

BRIDGEWATER, N. S., CAN.—Plans are being considered by the Canadian Mines Company for the construction of a hydro-electric power plant to supply electricity to operate the mines and to supply the City of Bridgewater with electricity for lamps and motors. The company also proposes to furnish the surrounding territory with electrical service.

MONTREAL, QUE., CAN.—Contracts have been placed by the trustees of the McGill University for the installation of a power plant for the university, at an approximate cost of $150,000. Prof. R. J. Durley, of McGill University, will have charge of construction of the plant.

ALLAN, SASK., CAN.—The town has taken advantage of the government offer of assistance to build a local telephone system and has ordered 85 miles of wire.

NORTH BATTLEFORD, SASK., CAN.—The citizens at a recent election voted in favor of the by-law to issue $75,000 to establish an electric light plant and water-works system. It is stated that work will commence on construction of the plant within 30 days.

PRINCE ALBERT, SASK., CAN.—The city is planning to construct a power plant at La Colle Falls, on the North Saskatchewan River, 26 miles north of the city, where it is proposed to develop 10,000 hp. C. E. Mitchell, of Toronto, Ont., is engineer.

SASKATOON, SASK., CAN.—Sealed tenders will be received until June 22 by J. H. Truesdale, city clerk, for one 500-kw, 2200-volt, 60-cycle, 150 r.p.m., two-phase generator, exciter and switchboard installed complete, and a 750-hp, 150 r.p.m., vertical Corliss engine, with necessary condensing apparatus, installed complete.

WOLSELEY, SASK., CAN.—At a recent meeting of the shareholders of the Ellisboro Rural Telephone Company it was decided to make a call of 50 per cent on the shareholders for new construction. For further information, address J. H. Berry, Wolseley, Sask.

CHIHUAHUA, MEX.—The Mexican Northern Electric Power Company has practically completed negotiations for the purchase of the concession for the establishment of a large hydro-electric plant and system of transmission lines in the State of Chihuahua. This company is composed of Canadians who are largely interested in the electric power and transmission system at Necaxa and Mexico City. The company has a capital stock of $10,000,000 and already owns a concession for the installation of a large hydro-electric plant at La Jara, State of Chihuahua. The concession which it has just purchased was owned by Governor Enrique C. Creel, of Chihuahua; Paul Ginther, of Santa Rosalia, and others. It authorizes the installation of a hydro-electric plant on the Conchos River about 17 miles above Santa Rosalia, State of Chihuahua. A large dam will be built across the river, by means of which about 24,000 hp will be developed. It is proposed to build transmission lines from the proposed hydro-electric station to the city of Chihuahua and the mining districts of Parral, Santa Eulalia, Almolaya, Naica and others. The concession also embraces the right to irrigate 150,000 acres of the Conchos River vallay land from the water of this storage reservoir. The site of the proposed dam and reservoir has been surveyed by the company's engineers. G. F. Greenwood, of Montreal, is president of the company; F. M. Brookfield, W. D. Ross, B. F. Pearson and L. A. Campbell, all of Montreal, Canada, are also interested in the enterprise.

GUADALAJARA, JALISCO, MEX.—The Southern Pacific Company is reported to be considering the question of constructing an electric railway about 16 miles in length to connect Guaymas with Aurora, San José de Guayma and Empalme.

GUADALAJARA, MEX.—The first shipment of iron towers for building the electric transmission line from Guadalajara to the mining districts of Etzatlan and Hostotipaquillo, State of Jalisco, have arrived and work will soon be started on erection of line. It is stated that 1000 of these towers will be required. Electricity will be obtained in the beginning from the Las Juntas plant of the Compania de Tranvias, Luz y Fuerza, of Guadalajara, but the contract has been let for the installation of a new hydro-electric plant on the Santiago River, near Guadalajara, from which electrical service will eventually be obtained. The new plant will have a capacity of 12,000 hp. It is planned to have the transmission line erected so that electricity can be furnished the two mining districts by Oct. 1, 1909.

GUAYMAS, MEX.—An American syndicate, headed by Epes Randolph, of Tucson, Ariz., head of the Cananea, Yaqui River & Pacific Railroad Company in Mexico, is planning to build an electric railway 16 miles long to connect Guaymas with suburban towns of Aurora, San Jose de Guaymas and Empalme.

MATAMORAS, MEX.—A stock company composed of Brownsville, Tex., and Matamoras men, to be capitalized at $20,000, is being organized to install an electric light plant in Matamoras, for which franchises and rights-of-way have already been obtained.

MEXICO CITY, MEX.—The recent cave-in at one of the dams of the Mexican Light & Power Company at Necaxa caused a damage of about $1,500,000.

MEXICO CITY, MEX.—The electric railway which the Canadian syndicate, headed by Dr. F. S. Pearson, proposes to build between Mexico City and Puebla, will be one of the greatest scenic routes in Mexico. The route selected for the proposed line runs between the two volcanes, Popocatepetl and Ixtaccihuatl. The railway will be about 90 miles long, and will pass through the town of Amecameca, situated at the foot of Popocatepetl Mountain, which is the starting and outfiting point for persons who attempt to climb the mountain. Electricity for operating this road will be obtained from the hydro-electric plant of the Mexican Light and Power Company, at Necaxa.

NEUVA LAREDO, MEX.—The Neuva Laredo Light & Power Company has awarded the contract for the installation of a large electric light and power plant. This company is said to also have under consideration the construction of an electric street railway in the town. Heretofore the city has been receiving electricity for lamps and motors from the plant of the Laredo Electric & Railway Company, of Laredo, Tex., situated on the other side of the Rio Grande River.

New Industrial Companies.

THE ALBIN GUSTAFSON COMPANY, of New York, N Y., has filed articles of incorporation, with a capital stock of $20,000, for the purpose of carrying on an electrical contracting business. The incorporators are Albin Gustafson, Harry R. King and Frederick E. Piper, of New York, N. Y.

THE AMERICAN ELECTROPLATING COMPANY, of Brooklyn, N. Y., has been chartered, with a capital stock of $25,000, by W. F. Kruse and C. H. Furgang, of New York, N. Y., and E. D. Kenyon and H. L. Huber, of Brooklyn, N. Y. The company proposes to do electroplating and reclaiming all metals.

THE AUTOMATIC WELDING COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $50,000, to manufacture automatic machinery. The incorporators are E. J. Forhan, H. M. Browne and J. J. Harper, of New York, N. Y.

THE BOONVILLE COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $5,000. The incorporators are: Frank Senoir, of Montgomery, N. J.; Frederick J. Parker, of New Canaan, Conn., and Frank M. Talbot, of Glen Ridge, N. J. The company proposes to do a general contracting and engineering, quarrying and building business.

THE ELECTRO-CHEMICAL PULP & PAPER COMPANY, of Auburn, Mass., has filed articles of incorporation to handle patents and patents rights. The company is capitalized at $500,000, and the officers are: H. W. Oakes, president, and E. M. Hatch, treasurer, both of Auburn, Mass.

THE ILLINOIS POLE & POST COMPANY, of Mattoon, Ill., has been incorporated by Charles Taylor, John Merchant and James Vause, Jr. The company is capitalized at $35,000 and proposes to manufacture poles and posts and other timber products.

THE INDICATOR ELECTRIC COMPANY, of Chicago, Ill., has been chartered with a capital stock of $30,000 to manufacture electrical appliances by M. R. Leahy, A. A. Radtke and E. Gorman, of Chicago, Ill.

THE JONES REFRIGERATING MACHINE COMPANY, of Elgin, Ill., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing engines, motors and machines by C. E. Zollars, R. B. Clark and B. Taylor.

THE KENNEBESTOS VALVE COMPANY, of Clinton, Mass., has been chartered, with a capital stock of $25,000, for the purpose of manufacturing and selling machinery. D. E. Purbeck, of Boston, Mass., is president, and H. E. Whitcomb, of Worcester, Mass., is treasurer.

JOHN H. LAMSON & BROTHER, of New York, N. Y., has been incorporated with a capital stock of $150,000 by E. Lamson, of Summit, N. J.; J. D. Baker, of Summit, N. J., and G. A. K. Sutton, of New York, N. Y. The company proposes to deal in manganese, asphaltum, pitch, carbons and chemicals.

THE PRIME ELECTRIC COMPANY, of New York, N. Y., has been incorporated by H. M. Underwood and J. Marvin, of New York, N. Y., and C. E. Whitney, of Hastings-on-Hudson, N. Y. The company is capitalized at $50,000, and proposes to deal in steam and electrical specialties.

THE J. W. A. RICHARDSON COMPANY, of New Orleans, La., has been incorporated by Joseph W. A. Richardson, Morris Marshall and Henry D. Richardson. The company is capitalized at $10,000 and proposes to do electrical work.

DE RUYTER VAN ORDEN has filed articles of incorporation, with a capital stock of $9,000. The incorporators are De Ruyter Van Orden and Ella B. Van Orden, of New York, N. Y., and Robert C. Striker, of Brooklyn, N. Y. The company proposes to do an electrical contracting business.

THE STEAM-GASOLINE ENGINE MANUFACTURING COMPANY, of Brooklyn, N. Y., has been incorporated, with a capital stock of $5,000, by George McDowell and John Fraas, of Brooklyn, N. Y., and Edward Effinger, of New York, N. Y., and others. The company proposes to manufacture engines, boilers, etc.

THE STERLING ASBESTOS COMPANY, of New York, N. Y., has been chartered, with a capital stock of $10,000, by George P. Fall and Armand DeR. Meyers, of New York, N. Y., and Herbert S. Fitzgibbons, of Brooklyn, N. Y. The company proposes to manufacture packing for steam and other engines, manufacturing heavy and shelf hardware, etc.

THE TOBACK LOCK COMPANY, of New York, N. Y., has been incorporated by Moses B. Cohen, of New York, N. Y.; Leopold Toback, of Union Hill, N. J.; Harry Toback, of Bayonne, N. J., and Frederick Hermann, of New York, N. Y. The company is capitalized at $500 and proposes to manufacture appliances for shutting off water, gas and electricity.

Company Elections.

CONDON, ORE.—At the annual meeting of the Waco County Electric & Water Power Company the following-named officers were elected: George S. Carpenter, president; H. I. Keeney, first vice-president; C. W. Lord, secretary; C. S. Graves, assistant secretary; F. T. Hulbert, treasurer: W. H. Hurlbert, general manager, and H. C. Smith, superintendent. The trust deed for the $15,000,000 bond issue of the company, as approved by the Carnegie Trust Company, was approved by the stockholders.

BLOOMSBURG, PA.—The Columbia Power, Light & Railways Company has been organized and the following-named officers elected: E. R. Sponsler, of Harrisburg, Pa., president; Myrom I. Low, of Lime Ridge, Pa., vice-president; A. W. Duy, of Bloomsburg, Pa., secretary, and M. Milleisen, of Bloomsburg, Pa. The company has absorbed 30 miles of electric railways, four electric light and two gas plants, consolidating six independent light and power plants.

New Incorporations.

CRESCENT CITY, CAL.—A charter has been granted to the Smith River Electric Company, which proposes to construct two power plants on Smith River to generate electricity, which will be distributed in Humboldt County, California, and portions of Josephine County, Oregon.

LOS ANGELES, CAL.—The Westside Electric Company has been chartered, with a capital stock of $75,000, by C. W. Anderson, R. C. Shippee, J. F. Stratton, Jacob Feiber and F. V. Gordon.

LOS ANGELES, CAL.—Articles of incorporation have been filed for the Surf Light & Power Company by C. W. Hicks, Charles Kraft, J. L. Haley, J. L. Kroeger, J. H. Maurice and others. The company is capitalized at $1,000,000.

NEWPORT BEACH, CAL.—Articles of incorporation have been filed for the Newport Bay Electric Light & Power Company with a capital stock of $50,000.

SAN GABRIEL, CAL.—The San Gabriel Valley Home Telephone Company has filed articles of incorporation, with a capital stock of $209,000. The incorporators are H.F. Metcalf, H. V. Carter, Edgar O. Fawcett, E. E. Bailey and W. M. Northrup.

HOLLYVILLE, DEL.—The Indian River Telephone Company has been incorporated, with W. J. Hunter as president; J. W. Hunter, vice-president; Harry Prettyman, secretary, and Harry J. Anderson, treasurer.

ELBERTON, GA.—The Interstate Power Company has been chartered, with capital stock of $3,000,000, by J. J. Spalding, of King & Spalding, of Atlanta, Ga.; Thomas J. Brown, of Elberton, and E. Marvin, of Underwood, Ga.

LENZBURG, ILL.—The Hickory Grove Telephone Company has been incorporated, with a capital stock of $150,000, by Herman M. Eckert, Michael Muser, Fred Huth and William Muser.

OBLONG, ILL.—The Oil Belt Traction Company has been incorporated by C. E. Groves, D. W. Odell, D. J. Odell, George P. Purrin, F. D. Willard, all of Oblong, Ill. The company is capitalized at $100,000, and proposes to construct a railway from Charleston to Bridgeport, Ill.

CRAWFORDSVILLE, IND.—Articles of incorporation have been filed for the Crawfordsville Heating Company by Moses H. Ristine, W. P. Herron, William B. Lynch, James E. Evans, Dumont M. Peck, Rankin C. Walkup and George B. Luckett. The company is capitalized at $100,000, and proposes to supply light, heat, water and power in Crawfordsville.

OSKALOOSA, IA.—The Oskaloosa Home Telephone Company has been chartered, with a capital stock of $150,000, by J. S. Appelman and H. H. Evans.

GEORGETOWN, KY.—The Georgetown Telephone Company has been incorporated, with a capital stock of $9,000, by A. P. Goodner and others.

BROWNVILLE, MAINE.—The Brownville Telephone Company has been chartered, with a capital stock of $5,000, and the following-named officers: E. M. Johnston, president and treasurer, and W. H. Monroe, clerk, both of Brownville.

FALMOUTH, MASS.—The Buzzards Bay Electric Company has been incorporated, with Allen A. Brown as president and Eugene Carpenter treasurer. The treasurer's office will be located in Falmouth from June 1 to Sept. 30, and in Newton from Oct. 1 to May 31.

HOXEYVILLE, MICH.—The Hoxeyville & East Lake Telephone Company has been organized to construct a telephone line from East Lake to Hoxeyville, a distance of 25 miles.

PIPESTONE, MINN.—The Altona-Fountain Prairie Rural Telephone Company has been formed to construct a telephone line from Luctor and Verdi, thence to Pipestone, where connection will be made with the Northwestern Telephone Exchange Company's system.

PIPESTONE, MINN.—Another rural telephone company has been organized in Pipestone, under the name of the Midway Telephone Company. The telephone line will be nine miles long and will connect with the Northwestern Telephone system at Pipestone. J. E. Morgan is president; John Danneker, vice-president, and George McCarter, secretary and treasurer.

VIRGINIA, MINN.—Articles of incorporation have been filed for the Virginia Electric Power & Water Company by W. K. McLennan, Arthur H. Brown, William Elder, Arthur Howell and M. E. Riley. The capital stock of the company is placed at $200,000.

LICKING, MO.—The Missouri Inland & Southern Railway Company has been chartered with a capital stock of $400,000 to construct an electric railway from Rolla to Licking. The directors are: Albert Campbell and C. H. Evers, of Spokane, Wash.; A. E. Young, E. C. Comstock, A. H. Bradford and D. M. Meadows, all of Licking, Mo.

MOUND CITY, MO.—The Mound City Electric Light & Ice Company has been incorporated, with a capital stock of $25,000, by E. M. Miller, R. W. Neill, T. W. McCoy and others.

NEW YORK, N. Y.—The Third Avenue Bridge Company has been incorporated by Alfred D. Sage, Walter J. Quinn, John E. Quinn, William P. Seaver, James F. Feeley, Raymond O'Neill and Edwin Goodwin, of New York, N. Y.; Walter C. Burrows, of Brooklyn, N. Y., and Louis Kayer, of Mount Vernon, N. Y. The company is capitalized at $20,000 and proposes to construct a street railway about two miles in length over the Queensboro Bridge, extending from Third Avenue and Fifty-seventh Street, Manhattan, to the Queens terminus of the bridge at Jackson avenue, Long Island City.

NEWBERN, N. C.—The Newbern Power Company has filed articles of incorporation, with a capital stock of $500,000. The incorporators are R. P. Foster, J. W. Stewart, R. A. Nunn and M. D. Lane.

MT. JOY, OHIO.—The Scioto County Independent Telephone Company has been incorporated with a capital stock of $7,500 by Mark Crawford and others.

HOLLISTER, OKLA.—The Hollister Mutual Telephone company has been chartered with a capital stock of $5,000, by J. W. Farrington, C. A. Noder, G. O. Winningham and others.

JEFFERSON, OKLA.—Articles of incorporation have been filed for the Jefferson Power & Improvement Company by D. E. McNeff, E. L. Quigley and A. B. Ginter. The capital stock of the company is placed at $100,000.

EUGENE, ORE.—Articles of incorporation have been filed for the Eugene-Pacific Western Railroad Company, with a capital stock of $300,000, to construct an electric railway from Eugene to Florence. The company will take over the franchise and privileges of the Eugene & Pacific Electric Railway, recently organized to build an electric railway to the coast. The incorporators are: F. J. Bergot, F. A. Anderson and Joseph Fellman, of Eugene, Ore.

MEDFORD, ORE.—The Medford & Butte Falls Telephone Company has been incorporated with a capital stock of $5,000 to construct a telephone line from Butte Falls to Eagle Falls, and thence to Medford. B. F. Harris and others are interested in the project.

BEDFORD, PA.—Articles of incorporation have been filed for the Friend's Cove Telephone Company, with a capital stock of $10,000, by C. P. James, of Rainsburg, Pa.; John C. Koontz and D. P. England, of Everett, R. F. D. No. 2; S. T. Diehl, of Charlesville, Pa.; Clayton Smith and M. A. Diehl, R. F. D. No. 4, Bedford, Pa.

CENTERVILLE, S. D.—Articles of incorporation have been filed for the South Dakota Interurban Railway Company, with a capital stock of $1,000,000, to construct an electric railway from Sioux City to Bijou Mills, a distance of 160 miles. The directors are: William E. Miller, Fred E. Graves, Ralph W. Thwing and Charles E. Todd, of Bijou Hills, and George A. Miller, of Academy.

HURON, S. D.—The Huron Municipal Telephone Exchange has been chartered, with a capital stock of $50,000, by F. H. Kent, S. P. Malone, Charles F. Koepp, J. R. Hinman and others.

DRESDEN, TENN.—The Farmers' and Merchants' Telephone Company has been organized with the following-named officers: C. C. Wells, president; W. T. Killebrew, secretary and treasurer. The company has taken over the equipment of the old rural telephone company, which will be thoroughly overhauled and put in good condition. Extensions will be made immediately to Gleason, Sharon, Martin and other points in the county.

HILLSDALE, TENN.—The Hillsdale Home Telephone Company has been granted a charter. The company is capitalized at $400, and the incorporators are J. P. Cothron, T. J. Thompson, W. C. Gregory, J. B. McGuffee and L. F. Woodmore.

LEXINGTON, TENN.—The Home Exchange Company has been organized to give complete telephone connection with the exchange at Sardis, Saltillo, Henderson, Scott's Hill, Decaturville and Lexington. The central offices will be located in Lexington. The promoters of the company are: Dr. J. C. Stinson, of Center Point, Tenn.; E. L. Fesmire and J. F. Hawthorne, of Lexington.

MEADOW VIEW, VA.—The Rural Telephone Company has been chartered, with a capital stock of $5,000. The officers are: W. H. Giesler, of Meadow View, Va., president; J. B. Greever, of Meadow View, vice-president; G. H. Hayter, of Abingdon, Va., secretary, and J. W. M. Whitten, treasurer.

ALDERDALE, WASH.—The Columbia Telephone Company has been chartered, with a capital stock of $10,000, by Alexander B. Robert, William Warner and Robert W. Bryan.

MILES, WASH.—The Spokane & Columbia Rivers Farmers' Telephone Company has been organized. The line will connect Spokane and Columbia valleys with central exchanges at Miles and Peach.

SEATTLE, WASH.—The Puget Sound Power Company has been incorporated, with a capital stock of $80,000,000, as a holding company to take over all the electric light, power and street railway systems in the northwestern part of Washington. Besides holding existing plants and properties, it is the intention of the company to continue interurban and power extensions now planned and to promote further extensions that will culminate in a continuous line of interurban railway from Vancouver in British Columbia to Portland, Ore., with a service to the Grays Harbor towns.

SPOKANE, WASH.—Articles of incorporation have been filed for the Big Bend Light & Power Company, with a capital stock of $300,000. The Montana office is located at Whitefish. E. Meesinger is the Montana agent.

WALLA WALLA, WASH.—The Washington Traction Company has been chartered, with a capital stock of $3,500,000 to construct a system of electric railways radiating out of Walla Walla to various towns in the eastern parts of Washington, Oregon and Idaho. The incorporators are Gilbert Hunt, B. C. Holt, J. B. Catron, J. C. Armstrong and J. L. Hundro.

HINTON, W. VA.—The Hinton Street Car & Transportation Company has been chartered with a capital stock of $50,000 by James T. McCreery, W. H. Sawyers, and others, of Hinton. The company proposes to construct a railway from Hinton, via Union, Avis and Red Sulphur Springs, to the N. & W. and Virginia railways, at the mouth of East River, Mercer County.

MARLINTON, W. VA.—The Marlinton & Stony Creek Mutual Telephone Company has been chartered to construct and maintain a telephone line between Marlinton and Laurel Creek. The incorporators are P. L. Carter, T. S. Dulany and others of Onoto, W. Va.

WHEELING, W. VA.—The Warwood Water & Light Company has filed articles of incorporation with a capital stock of $50,000. The incorporators are: B. W. Peterson, R. J. McCullogh, John A. Logan, and others.

ALAMENA, WIS.—The Alamena Farmers' Telephone Company has been incorporated, with a capital stock of $8,000, by G. R. Walter and others.

BOARDMAN, WIS.—The Boardman Rural Telephone Company has been incorporated with a capital stock of $3,000 by H. Robinson, James McHenry, Thomas Tobin and August Swanke.

LADYSMITH, WIS.—The Rush County Rural Telephone Company has been incorporated, with a capital stock of $8,000, by S. M. Alvey, E. C. Campbell, C. Joyner, Alden Laidlaw and G. B. Goocher.

NEW AUBURN, WIS.—The New Auburn Telephone Company has filed articles of incorporation, with a capital stock of $4,000. The incorporators are H. McCormick, G. M. Engebretson, A. J. Amundson, G. E. Hutchinson and C. E. Bitney.

DRUMMONDVILLE, QUE., CAN.—The Drummondville Telephone Company has been incorporated with a capital of $20,000. The directors are N. Garceau, A. O. Duclos and O. Brouillard, all of Drummondville, Que., Can.

Personal.

SIR EDWARD CLOUSTON, of Montreal, Que., Can., has been elected a director of the Kaministiquia Power Company, of Fort William, Ont.

MR. JOHN J. CARTY has received from the Emperor of Japan the decoration of the Order of the Rising Sun in recognition of engineering services rendered to Japan.

MR. J. G. GLASSCOE, of Hamilton, Ont., Can., has been appointed assistant power engineer in connection with the civic power development at Point du Bois, now being undertaken by the city of Winnipeg, Manitoba.

MR. RAY H. TABER has been elected chairman of the Worcester Polytechnic branch of the American Institute of Electrical Engineers, and will attend the Frontenac Convention as a delegate of the branch. Mr. Taber is a post-graduate student in electrical engineering.

MR. NICHOLAS I. QUINT, who has been superintendent of the municipal light plant in Peterboro, N. H., for the past three years, has resigned. Mr. Carey A. Walbridge, who has been assistant at the plant for some time, has been appointed superintendent to succeed Mr. Quint.

PROF. KENGO MAKINO, of the department of electrical engineering, University of Waseda, Tokyo, Japan, is now on his way home via Europe after about a couple of years spent at Cornell in post-graduate work. He sails this week, but has been visiting Columbia, Stevens and other institutions before his departure.

DR. A. E. KENNELLY was one of the delegates representing Harvard University at the inauguration on Monday of Dr. MacLaurin as president of the Massachusetts Institute of Technology. Dr. Kennelly served in a similar capacity for the Finsbury Technical School, London, at the inauguration of Dr. Pritchard some years ago.

MR. KENNETH W. ENDRES, who for the past four and one-half years has been with the engineering department of the American Telephone & Telegraph Company in Boston and New York, has resigned from that company to accept a position in the Pennsylvania sales office of the Electric Storage Battery Company at Philadelphia.

MR. M. B. HUFF has been appointed general sales agent of the Garwood Electric Company. Mr. Huff is a well-known power engineer in central station circles, having been for six years connected with the Philadelphia Electric Company, and for the past two years with the United Electric Company. Mr. Huff's office will be at Garwood, N. J.

MR. MARTIN J. INSULL, general manager of the Louisville & Northern Railway & Lighting Company, has been appointed operating manager of the Indianapolis & Louisville Traction Company, with headquarters in New Albany. He succeeds Mr. W. S. Kuhn, of Pittsburgh, who has been the operating manager since the resignation of Mr. A. A. Anderson a year ago.

MR. KARL M. WAY, E. M., formerly assistant engineer, Fuel Testing Branch, U. S. Geological Survey, engaged in mine inspection, mine sampling and studies of coal preparation in all important coal fields of the United States, has recently been appointed assistant mining engineer upon the staff of the Fuel Engineering Department of the Arthur D. Little Laboratory of Engineering Chemistry, Boston, Mass. Mr. Way is a graduate in mining engineering of the Ohio State University.

MR. ARTHUR WILLIAMS, of the New York Edison Company, has been elected a director of the Museum of Safety & Sanitation, his colleagues being Judge Elbert Gary, Richard Watson Gilder, Professor Irving Fisher and Commissioner of Health Darlington. He and Mr. T. C. Martin have also been made members of the American section of the Ninth International Congress of Improved Dwellings, to be held at Vienna, May, 1910; and a special request is made for all data bearing on the use of electricity affecting the home comfort of artisans.

MR. R. H. MANAHAN, the city electrician of Los Angeles, Cal., is now visiting the East and is making a special expert study of all the new developments in street lighting as exemplified in Chicago, New York and particularly in Boston. He finds much that is new and interesting. Los Angeles has some 6 miles of low-post lighting with 616 post, of carbon lamp clusters averaging about 700 watts per cluster, the posts varying in style. Mr. Manahan will spend two or three weeks before going home. The street lighting contract of Los Angeles is renewable next year.

MR. PERRY BARKER, M. S., member of the American Chemical Society, recently assistant engineer U. S. Geological Survey at the fuel-testing plants at St. Louis and Jamestown, and later at the experimental gas plant, Ann Arbor, in charge of tests of gas coals, has been made assistant chemical engineer on the staff of the Fuel Engineering Department of the Arthur D. Little Laboratory of Engineering Chemistry, Boston, Mass. Mr. Barker, who is a graduate in chemical engineering of the University of Illinois, was formerly chemist to the Peabody Coal Company, Chicago, and research chemist at the Illinois State Engineering Experiment Station.

MR. LEWIS B. SHARP, who resigned recently as general manager of the Queens Borough Gas & Electric Company, of Far Rockaway, L. I., was given a banquet at the Manhattan Beach Hotel on June 1, when 40 of the officers and force were present. Mr. Sharp has of late been very successful in real estate development in the Rockaways, and is now giving his whole time to such work. At the dinner he was handed a very substantial check by President Carleton Macy on behalf of the company, accompanied by a handsomely engrossed record of his work in the lighting field since 1884. Then his fellow-employees presented him with a beautiful silver loving cup bearing an appropriate inscription.

MR. C. F. PARKER, general purchasing agent for the Illinois Central Railroad, was the speaker at the meeting last week of the Chicago Electric Club and discussed the effect of recent extreme action by the interstate commerce commissions. He made the statement that the surplus of one of the most prosperous railroads had been entirely wiped out in 1908 and that its earnings barely paid the interest on its bonds and the dividends on the stock. He also touched on the general movement which is now taking place to educate the public to remedy this condition of affairs. He solicited the earnest co-operation of the business men whose livelihood is so largely dependent on the railroads for their business.

MR. J. R. BIBBINS, who since 1902 has been associated with the Westinghouse interests at Pittsburgh, Pa., recently serving the Westinghouse Machine Company as commercial engineer, after June 18, will become associated in the work of the Public Service Commission of New York as assistant to Mr. B. J. Arnold, consulting engineer and director of appraisals. Mr. Bibbins is a graduate of the University of Michigan, and has served in various technical capacities with the Detroit Public Lighting Commission, the Detroit Edison Company and the Detroit United Railways Company, in operating and construction work. During his late connection with the Westinghouse Machine Company Mr. Bibbins' work

has included an intimate association with the development of prime movers at East Pittsburgh, including gas engines, producers, turbines and condensers. His new offices will be in the Tribune Building, City Hall Square, New York.

Obituary.

MR. CHARLES W. DOUGLAS, who is said to have been the first telegrapher to receive messages by sound, died in Wayne, N. J., May 31, at the age of 75 years. In 1851 he was appointed train dispatcher for the Erie Railroad, and in later years held important positions on other railroads.

MR. IRVING LOVERIDGE.—A cable dispatch from Berlin announces the death in that city June 4 of Mr. Irving Loveridge, general European superintendent for the Western Electric Company, at the age of 49 years. Mr. Loveridge was born in Rochester, N. Y., in 1860 and was graduated from the University of Rochester in 1882. He was employed by the Western Electric Company from 1882 to 1892, and was afterward manager of the Bell Telephone Manufacturing Company in Antwerp. Mr. Loveridge's headquarters were in London, and he was on an annual inspection tour of the Western Electric Company's continental offices at the time of his death. The remains will be taken to Rochester for burial. Mr. Loveridge was a member of the A. I. E. E. He is survived by his wife.

MR. CHARLES L. BUCKINGHAM, well known as an inventor in the field of telegraphy and as a patent lawyer, died at his home in New York City May 31, after an illness of about five weeks. Mr. Buckingham was born at Berlin Heights, Ohio, Oct. 14, 1852, and was educated at the University of Michigan and Columbia University. He was for many years counsel for the Western Union Telegraph Company, and was the inventor of a typewriting system of telegraphy which was used on that company's lines for a time. He was also counsel for the General Electric Company, the Westinghouse Electric & Manufacturing Company, the Edison companies, and other electrical interests, and was one of the counsel in the suits involving the Tesla patents. Mr. Buckingham was one of the five who purchased for donation to the Library of the American Institute of Electrical Engineers a valuable classified collection of all U. S. electrical patents issued down to 1891, numbering over 100 volumes. Two sons survive him.

Trade Publications.

FIREPROOF WIRING SYSTEM.—A. L. Goldschmidt, of New York, has patented a fireproof wiring system, consisting essentially of rigid uncovered conductors continuous throughout the building to be wired, permanently separated from each other and from a rectangular metal conduit resembling a mail chute, in which they are contained, and in which are also mounted the distributing, controlling and safety appliances. He describes his system in an eight-page pamphlet.

STORAGE BATTERIES.—The Standard Electric Accumulator Company of New Jersey in its latest bulletin describes the S. E. A. battery. This has the same chemical properties as well as the good qualities of the lead accumulator; but instead of grids, has thin and very porous porcelain plates which completely enclose the active material and its electrode. Some general instructions on the care and operation of storage batteries are included in the bulletin.

Business Notes.

THE LORD ELECTRIC COMPANY reports that it has just closed a contract for nearly $500,000, which includes among other material its laminated soldered rail bonds. This is one of the largest contracts ever closed by this company.

MR. ALEX. HENDERSON is just home in New York after an 18,000-mile circular trip in the interests of Circular Loom. He begins circulating again on Wednesday. Altogether he brings back a cheerful report of the general outlook, especially in the Southwest.

TAYLOR MECHANICAL STOKERS.—The Stone & Webster Engineering Corporation has recently placed an order with the American Ship Windlass Company, Providence, R. I., for three Taylor mechanical stokers for installation at the Dalias Electric Light & Power Plant, for which six similar stokers were previously purchased.

THE O'BRIEN ELECTRIC COMPANY.—The property of the O'Brien Electric Company, of Philadelphia, Pa., was sold at a receiver's sale May 20 to William P. Fairman, of Fairman & Company. The company was capitalized at $1,500,000 and was incorporated under the laws of Arizona in 1906 for the purpose of manufacturing a new tubular electric light bulb. It is said that Mr. Fairman proposes to continue the manufacture of the lamps. Harry D. Wescott acted as receiver.

THE MOORE ELECTRICAL COMPANY has just finished an installation in the United States Government Bureau of Standards, Washington, D. C., consisting of two tubes, one white and the other yellow. Various tests will be made, the most important of which, however, is to test the claim that the average color values of the Moore white tubes are as nearly the equivalent of average daylight as will ever be obtained, and that it should, therefore, be adopted as the standard light for color values.

THE FEDERAL SIGN SYSTEM has recently opened a branch office at 1230-1231 Syndicate Trust Building, St. Louis, Mo. This makes eight offices in all which this company now maintains—one in each of the following cities: New York, Cincinnati, Kansas City, Philadelphia, Louisville, New Orleans, St. Louis and Chicago. In each of these cities the Federal Sign System (electric) has developed a considerable sign-renting business as well as a large sales business of electrical fixtures of all kinds.

THE BOSTON INSULATED WIRE & CABLE COMPANY has its new factory in the Dorchester district, now building by the Aberthaw Construction Company, of Boston, well under way. On account of its location on a soft marsh, it was necessary to drive piles. These were capped with reinforced-concrete footings and piers, which support the first floor. The latter serves as a platform for carrying the superstructure of the building. This design saves the expense of all wall foundations and the whole structure is carried on well-distributed piers.

ALFRED T. MOORE, Philadelphia, has established a sales agency with Mr. Frank W. Pardee, 56 Fifth Avenue, Chicago, who will carry a stock of insulated wire, telephone cords, etc. Mr. Pardee has been connected with the telephone and electrical business for about 12 years, during which he has formed a wide acquaintance in the trade. Alfred F. Moore's concern is one of the oldest manufacturers of insulated wire in the country and it will doubtless be gratifying to many Western companies to know that they can obtain from Chicago stock Moore's standard line of telephone receiver cords, switchboard cords, jumper wire, junior jumper wire and other classes of well-known Moore goods.

THE MACBETH IRON COMPANY, of Cleveland, engineers, founders and machinists, builders of blowing engines, etc., and the Bruce-Meriam-Abbott Company, also of Cleveland, builders of gas engines, were consolidated on June 1, the name of the new company being The Bruce-Macbeth Engine Company. The Macbeth Iron Company dates from the year 1870, having been known until late years as Macbeth & Company. The Meriam-Abbott Company, predecessors of The Bruce-Meriam-Abbott Company, was organized in 1900, and has been one of the pioneers in the manufacture of the commercial gas engine and its development. It is the purpose of The Bruce-Macbeth Engine Company to continue the business of both of the former companies on a much larger scale than before. The manufacture and development of the gas engine will be continued and the former line of work of The Macbeth Company will be conducted as heretofore. The new company will concentrate the two present plants at the former plant of The Macbeth Iron Company, on Center Street, N. W., Cleveland. Alterations to the present buildings will be made and several new buildings will be erected to accommodate the enlarged business, and the combined equipment of the two companies in one plant will make a very complete and modern shop. The officers of the company are as follows: President, W. C. Bruce; vice-president, C. W. Kelly; secretary and treasurer, C. J. Snow; manager, C. E. Curtiss. The above, with A. D. Macbeth, J. B. Meriam and F. B. Abbott, constitute the board of directors. Mr. Bruce, president, was formerly president of The Bruce-Meriam-Abbott Company; Messrs. Kelly, Snow and Curtiss retain the same positions formerly held in The Macbeth Iron Company.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 1, 1909.

[Conducted by Wm. F. Bissing, Pat. Law, 2 Rector St., N. Y. City.]

923,157. STARTING DEVICE FOR ELECTROMETERS; K. Von Dreger, Berlin, Germany. Makes use of an operating handle with a drum having an irregular waved surface which co-operates with a spring-pressed detent so as to control the starting.

923,179. SEPARABLE ATTACHMENT PLUG; H. Hubbell, Bridgeport, Conn. App. filed Oct. 30, 1908. Has an insulating body with a screw shell enclosing the body.

923,185. CIRCUIT CLOSER FOR RECORDING ANEMOMETERS; J. C. Jurgensen, Tappan, N. Y. App. filed March 9, 1908. Provides a wheel driven by the shaft of the anemometer, which wheel has a groove in which a metallic ball travels.

923,186. AUTOMATIC MOTOR CONTROL; S. H. Kanmacher, Schenectady, N. Y. App. filed Oct. 15, 1906. Automatically breaks the motor circuit by a controlling switch which returns to off position when released and an overload magnet which releases the switch at the proper time.

923,194. CURRENT COLLECTOR FOR ELECTRIC CARS; G. Mertens, Blasewitz, near Dresden, Germany. App. filed Feb. 12, 1908. Comprises an arm with a wide flat curve collector bar rigidly secured thereto.

923,202. RELAY AND METHOD OF MAKING THE SAME; J. S. Pevear, Schenectady, N. Y. App. filed Aug. 24, 1907. A current-carrying coil is made of a spiral form and is connected at one end to a flexible conductor so as to permit the spirals to approach each other.

923,227. PURIFICATION OF POROUS MATERIALS; W. R. Whitney, Alplaus, N. Y. App. filed Jan. 17, 1906. Removes zinc chlorid from cellulose by washing the latter with a substantially isotonic solution of an organic substance and passing a current therethrough.

923,247. RELAY; A. S. Cubitt, Schenectady, N. Y. App. filed May 22, 1908. The actuating coil is energized from a circuit in which the current varies and a second coil produces a field in opposition to that of the first coil.

923,284. SOCKET LOCK FOR INCANDESCENT LAMPS; A. L. Lowe, Denver, Col. App. filed May 13, 1907. To avoid stealing incandescent lamps by providing a locking device which locks them to their sockets.

923,296. AUTOMATIC ELECTRIC BLOCK SIGNAL SYSTEM; H. W. Price, Toronto, Ontario, Canada. App. filed March 21, 1907. The block is divided into sections and a signal is carried in the engine cab.

923,311. ELECTRIC MOTOR; E. F. W. Alexanderson, Schenectady, N. Y. App. filed March 1, 1907. The motor is of the commutator type with series field. Makes use of a laminated stator with polar projections magnetizing coils in the spaces between the poles, a distributed winding on the pole faces and a rotor with coils of a fractional pitch.

923,312. SINGLE-PHASE MOTOR CONTROL; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Aug. 6, 1908. The motor is of the commutator type with exciting and compensating windings on the stator, and is provided with a suitable controller, with auxiliary controller for short circuiting the armature when starting under heavy load.

923,319. ROTARY ORE EXTRACTOR; J. O. Blackburn, Chloride, Ariz. Ter. App. filed Nov. 28, 1908. A rotary drum horizontally arranged carries the gold or silver which is to be extracted by amalgamation with mercury.

923,327. ELECTRICAL CONNECTION ROSETTE; J. L. Burton, Plainville, Conn. App. filed Oct. 17, 1908. The upper member is threaded externally and the lower member is connected thereto by a threaded coupling sleeve.

923,338. GROUND LEG CONNECTION FOR ELECTROLYTIC ARRESTERS; E. E. F. Creighton, Schenectady, N. Y. App. filed July 9, 1907. For high-voltage lines, in which an electrolytic condenser is placed in each phase connection and an auxiliary condenser of smaller capacity is connected in the ground connection.

923,385. TELAUTOGRAPH; G. S. Tiffany, Summit, N. J. App. filed July 6, 1906. Improvements on 668,889, etc.

923,411. MANUFACTURE OF ZINC-DUST; S. O. Cowper-Coles, London, England. App. filed Aug. 2, 1907. Electro deposits zinc in a spongy form and dries it in a reducing atmosphere.

923,425. DEVICE FOR SINGEING THREADS; G. Gin, Paris, and V. Courtecuisse, Lille, France. App. filed March 22, 1907. Makes use of a series of wires which are heated electrically and passed over the cloth to singe it.

923,439. ELECTRIC CUT-OUT; T. E. Murray, New York, N. Y. App. filed Jan. 13, 1909. The locking seal may be released and the fuse cases removed simultaneously or separately.

923,466. COMBINED FUSE AND SWITCH BOX; W. R. Vanaman, Atlantic City, N. J. App. filed June 10, 1908. A combined fuse and switchbox which permits of ready insertion and removal of a fuse without spading the third-rail shoes.

923,484. SUPPORT FOR CONTACT PLOWS; S. T. Bole, Philadelphia, Pa. App. filed June 24, 1908. Secures the plow in any desired position without interfering with the brake or motor mechanism.

923,488. PRINTING TELEGRAPH; H. W. Bull, Springfield, Mass. App. filed April 17, 1908. Improvements in the transmitting and receiving devices of a printing telegraph.

923,499. SIGNALING MEANS FOR TELEPHONE SYSTEMS; F. S. Davenport, Atlanta, Ga. App. filed April 30, 1907. Common battery private line telephone system having a plurality of signaling devices and an interrupter at the subscriber's instrument acting to cause a single tap at the bell.

923,508. VIBRATOR; M. K. Golden, San Francisco, Cal. App. filed March 28, 1908. The solenoid is bodily movable and rapidly vibrated so as to strike against the inside of a spherical shell producing the sound.

923,540. TROLLEY; H. Lietz, Pittsburgh, Pa. App. filed Jan. 9, 1909. A trolley replacing device, having replacing arms pivotally carried by the sides of the harp and extending above the wheel.

923,581. PROCESS FOR THE PRODUCTION OF CARBON-COVERED METAL SHEETS FOR DYNAMO BRUSHES; J. F. P. Ringsdorff, Essen-on-the-Ruhr, Germany. App. filed July 14, 1908. Produces carbon-covered metal sheets by smearing a carbon paste on the surfaces of the sheets and subjecting them to high pressure.

923,597. ELECTRICAL CONTROLLER; H. A. Steen, Edgewood, Pa., and A. J. Logan, Wilkinsburg, Pa. App. filed Sept. 3, 1907. An operating arm with a manually actuated latch and means for actuating the same carried by the arm for preventing the movement of a controller past the "off" position without bringing the handle to stop at said position.

923,598. INSULATED HANGER; L. Steinberger, New York, N. Y. App. filed April 28, 1903. Comprises a bell-shaped support open at the top and having a flange at the bottom and also having lugs forming a circle, with insulating material mounted therein.

923,601. TROLLEY STAND; E. W. Stull, Norwood, Ohio. App. filed Feb. 13, 1908. Has a low base with three sets of springs to hold the trolley to the wire.

923,603. TELEPHONE APPARATUS; W. H. Taylor, Stamford, Conn. App. filed Aug. 22, 1908. Provides an auxiliary magneto receiver which can be used in addition to the main receiver with a long-distance line.

923,614. ARMATURE CONSTRUCTION; B. A. Behrend, Norwood, Ohio. App. filed Sept. 19, 1904. Provides for the flux passing through the armature between any two field poles, paths of different lengths, but of equal reluctances, so that a substantially uniform flux density in the armature is obtained.

923,615. DYNAMO-ELECTRIC MACHINE; B. A. Behrend and E. Mattman, Norwood, Ohio. App. filed March 31, 1906. The dynamo has a stationary armature and a rotary field member comprising a spider with a rim and outwardly projecting field magnets secured thereto with fan segments secured to the rim to ventilate.

923,627. VOLTAGE REGULATOR; F. Conrad, Swissvale, Pa. App. filed Jan. 5, 1907. For supplying constant voltage by adjusting the field strength of the exciter of the generator.

923,637. TELEPHONE APPLIANCE; M. P. Flack, New York, N. Y. App. filed Dec. 16, 1908. Surrounds the transmitter with a seal for the mouth so as to prevent the sound from reaching others in the room and overhearing the conversation.

923,642. FUSE-PLUG; G. W. Goodridge, Bridgeport, Conn. App. filed Dec. 22, 1908. Relates to the Edison fuse-plug so as to eliminate strain upon the joint between the shell and the fuse strip.

923,646. SAFETY GAS APPLIANCE; F. Grott, New York, N. Y. App. filed Jan. 18, 1909. Oppositely disposed self-closing valves are carried by the casing and an inflammable thread connects the valves and holds them open and an ignitable pellet is located within the casing near the thread. Is placed in a mine to give warning of fire damp.

923,653. AIR OR WATER BLAST MAGNET; J. D. Hilliard, Jr., and C. E. Parsons, Glens Falls, N. Y. App. filed Jan. 29, 1906. A lifting magnet is provided with means for blowing air or water through it so as to clean off the face of the magnet.

923,666. PROTECTIVE DEVICE FOR COMMUTATOR TYPE ALTERNATING-CURRENT MOTORS; B. G. Lamme, Pittsburgh, Pa. App. filed June 30, 1904. In combination with a constant-speed commutator type of motor, of an interrupter, of a field magnet circuit which is opened quickly after a predetermined interval of time after the armature circuit is broken.

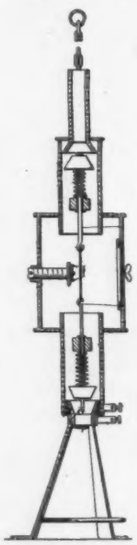
923,667. WINDING FOR ELECTRICAL MACHINES; B. G. Lamme, Pittsburgh, Pa. App. filed June 2, 1905. Winding for magnetizable cores having partially closed slots, the conductors being arranged in the slots in a plurality of layers separately insulated with an uneven number of groups per layer.

923,673. DYNAMO-ELECTRIC MACHINE; C. E. Lord, Norwood, Ohio. App. filed May 17, 1906. Dynamos with inwardly extending field poles, the poles having parallel ventilating passage ways at right angles to the axis of the machine.

923,686. PROTECTIVE CONDUIT HOLDER FOR ELECTRICAL CONNECTIONS; J. F. McElroy, Albany, N. Y. App. filed Sept. 11, 1908. An electric heater having insulated ends, with a heating coil between the ends and a rod extending through the coil and binding the parts of the heater together.

923,699. WIRELESS TELEGRAPHY; G. W. Pierce, Cambridge, Mass. App. filed Oct. 17, 1906. A tuning apparatus for wireless having a variable inductance coil connected with the antenna and a high-frequency transformer having a variable primary coil in series with the inductance coil.

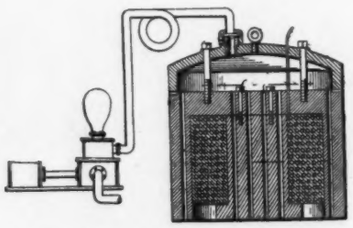
923,700. RECTIFIER; G. W. Pierce, Cambridge, Mass. App. filed Feb. 20, 1907. For rectifying alternating-currents for charging storage batteries by using an interrupter and a symmetrically conductive solid in a derived circuit to rectify and distort the alternating current therein.



923,646. — Safety Gas Appliance.

923,702. INTERLOCKING SWITCH AND SIGNAL SYSTEM; E. K. Post, Harrisburg, Pa. App. filed July 29, 1908. The combination of a power interlocking switch lever and connections and a mechanical switch or signal lever or connections using the same common machine for interlocking.

923,642.—Fuse Plug.



923,653.—Air or Water Blast Magnet.

923,745. PURIFICATION OF POROUS MATERIAL; W. R. Whitney, Alplaus, N. Y. App. filed Jan. 17, 1906. Removes zinc chloride from celluose by washing the latter and passing a current through the solution.

923,753. ALTERNATING-CURRENT MOTOR; E. F. W. Alexanderson, Schenectady, N. Y. App. filed May 1, 1907. Dynamo of the commutator type. Connections short circuit the rotor on a definite line and the stator winding has coils arranged in conjunction with the rotor to produce a flat-topped field in the direction of the line of the rotor short circuit and other coils produce a cross field.

923,754. ALTERNATING-CURRENT MOTOR; E. F. W. Alexanderson, Schenectady, N. Y. App. filed July 15, 1907. For commutation over a wide range of speed. Starts it as a repulsion motor with the armature short circuited, including an inductive winding in the armature short circuit for low speeds and a shunt voltage in the short circuit for high speeds.

923,774. ELECTROLYTIC CELL OR CONDENSER; E. E. F. Creighton, Schenectady, N. Y. App. filed Sept. 18, 1907. Comprises a plurality of oxidizable cups separate by an electrolyte containing citric acid.

923,796. BLOCK SIGNAL SYSTEM FOR ELECTRIC RAILWAYS; M. E. Launbranch, Chicago, Ill. App. filed Dec. 14, 1905. For electric railways making use of a single signaling wire between the blocks.

923,797. INCANDESCENT LAMP; R. McNeill, New York, N. Y. App. filed March 19, 1908. An anchor for a stretched filament having an eye with an extension yieldingly engaging the interior of the tube.

923,800. TRACK CONSTRUCTION AND ELECTRIC SIGNALING AND CONTROLLING EQUIPMENT THEREOF; G. Thompson, Milton, Conn., and W. H. Merchant, New York, N. Y. App. filed Feb. 27, 1905. For communicating to a second conveyance passing along the track and equipped with an electric signal-receiving device a primary danger signal indicating the occupancy of the track by the first conveyance.

12,924. PROCESS OF MAKING GRAPHITE; E. G. Acheson, Niagara Falls, N. Y. App. filed April 9, 1909. Introduces into the electrical furnace a mass of petroleum coke and also introduces therein oxide of iron, heats by means of a current which vaporizes the iron, forming a carbide, and graphitizes the carbon.